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A CONTRIBUTION TO THE CLASSIFICATION OF THE BLENNIOID FISHES OF THE FAMILY CLINIDAE, WITH A PARTIAL REVISION OF THE EASTERN PACIFIC FORMS[1]

By Clark Hubbs[2]

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[1] This paper is extracted from a dissertation submitted to the Graduate School of Stanford University, in partial fulfillment of the requirements for the degree of Doctor of Philosophy, and prepared under the supervision of Professor George S. Myers.

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I. INTRODUCTION

Statement of Problem

The blennioid fishes of late years grouped in the family Clinidae have not been systematically revised on a world-wide basis since Günther's treatment of 1861, where they were submerged in the inclusive family Blenniidae. In 1912, Regan reviewed the major classification of the blennioids, principally using osteological characters, splitting the old family Blenniidae into several, and defining the Clinidae in its modern sense. No one since Regan has made a world-wide study of this family, or of its relationships to other blenny groups. Moreover, Regan's work was evidently based upon osteological study of only a limited number of forms. Further knowledge of clinids has gradually accumulated through faunal studies or revisions and reports on isolated collections.

The author's interest in the group began with studies on the Californian forms, and, under the encouragement of Drs. Carl L. Hubbs and G. S. Myers, was expanded to embrace a general revisional study of the clinids of the Eastern Pacific. In order that the classification be securely based, it was found necessary to examine most of the known genera and to revise the entire supergeneric classification of the family. In addition, a new defi-

nition of the family, and a re-examination of its relations to other blenny groups, were found to be both useful and necessary. Discovery of a rather large number of new forms, and lack of time to treat them fully, have made it impossible to present a complete systematic treatment of the Pacific American genera and species. However, all described forms known to the author from this area are mentioned.

Intensive study of several species belonging to closely related genera has produced some interesting zoogeographic results. Early in the study it was observed that many species and subspecies have similar or comparable geographic ranges. These resemblances were to some extent expected because most of the species have rather like habits and habitats and would therefore to subjected to approximately the same limiting factors. Several of the apparent zoogeographic barriers indicated by the newly defined ranges are located in areas where no such barriers had previously been suspected. Moreover, because the clinids do not appear to move about very extensively as individuals, it was suspected that these zones of contact between allopatric clinid species might serve as excellent indicators of similar zones of contact between areas with minor oceanographic differences. This suspicion has been justified in large measure by the demonstration of correlation between geographic barriers for clinid species and known oceanographic changes along the California coast by C. L. Hubbs (1948). If the barriers for species of clinids or other marine animals are correlated with oceanographic differences in areas well known oceanographically, it is logical to assume that they would be so correlated in lesser known areas. For this reason, an analysis of marine animal distribution, which can be done easily and cheaply, might well precede oceanographic work in some regions and help to guide subsequent, expensive oceanographic expeditions.

In this connection, however, it is pertinent to emphasize the fact that conclusions based upon systematic work are no more reliable than the quality of that systematic work. Ecology, distribution, and phylogenetic speculations are meaningless if the basic systematics is poorly done. Previous knowledge of Pacific Coast clinids in Central America was not sufficient to use as a basis for such other work, but the author feels that the species of this small group of fishes may now serve as indicators of the distributional pattern of the entire shore-fish fauna of the tropical and temperate Eastern Pacific, and that similar groups, similarly studied, might prove equally valuable in other areas.

The objectives of this paper may then be stated as follows:

1. A general revision and reclassification of the supergeneric groups of clinid blennies on a world-wide basis.
2. A brief revision of our knowledge of the relationships of the family Clinidae as a whole to other related families and higher groups of fishes.
3. A partial revision and reclassification of the genera and species of Pacific-American Clinidae.
4. A study of the zoogeographic areas, boundaries, and relationships in the shallow-water fish fauna of the Eastern Pacific, based principally on the Clinidae.

The work was done principally in the Natural History Museum of Stanford University.

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Very extensive collections of blennies have been gathered from various museums and universities in the country. I am indebted to the following investigators and their assistants for placing specimens at my disposal: Dr. William Beebe and Mr. John Tee-Van of the New York Zoological Society, Dr. George S. Myers and Miss Margaret H. Storey of Stanford University, Dr.

Wilbert M. Chapman and Mr. W. I. Follett of the California Academy of Sciences, Dr. Carl L. Hubbs of the Scripps Institution of Oceanography, Dr. Boyd W. Walker of the University of California at Los Angeles, Dr. John Garth of the University of Southern California, Dr. Arthur S. Welander of the University of Washington, Mr. Loren P. Woods of the Chicago Natural History Museum, Dr. Leonard P. Schultz of the United States National Museum, Dr. Robert R. Miller of the United States National Museum and the University of Michigan, Dr. Reeve M. Bailey of the University of Michigan, Mr. John T. Nichols of the American Museum of Natural History, and Dr. J. L. B. Smith of Rhodes University College.

I am also indebted to the following individuals, who have assisted in the collection of various specimens used in this paper: Mr. Joseph W. Sefton, Mr. Errol I. Flynn, Dr. Carl L. Hubbs, Dr. Boyd W. Walker, Dr. William Beebe, the members of the Stanford Natural History Club, and others. Their help is greatly appreciated.

I am indebted to Dr. Donald E. Wohlschlag and Mrs. Carl L. Hubbs for assistance with the statistical procedure used in this work. The signed drawings were made by Miss Grace Hewitt and Miss Jean Allred. The remaining drawings were made by the author.

I am indebted to Dr. George S. Myers, Dr. Carl L. Hubbs, and Dr. Rolf L. Bolin for assistance in planning the problem. I am also indebted to the first two, and to Prof. Gordon F. Ferris, Dr. V. L. Vanderhoof, Miss Margaret H. Storey, and Mr. Spencer W. Symons, for reading and criticizing preliminary portions of the work.

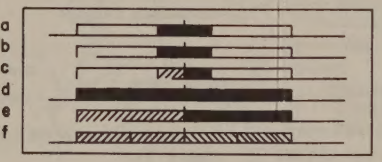
I am especially indebted to my wife, Catherine S. Hubbs, for her assistance and encouragement in writing the manuscript.

Methods

Measurements and counts used in this work have been usually those standard in ichthyology, but the accuracy of some measurements has been increased by using nonstandard techniques. The spinous rays were all measured from the posterior angle, formed by the junction of the distal or projecting portion of the spine and the expanded and imbedded basal portion, to the tip, instead of from some undefined position along the anterior base to the tip. All soft (or articulated) rays were measured from the proximal end of the articulating joint to the extreme tip of the ray. The body depth was measured from the base of the first anal spine to the closest point on the dorsal body profile. The caudal peduncle length was measured from the posterior base of the last anal soft ray to the median base of the caudal rays. The caudal peduncle depth was considered the least peduncle depth. The bony interorbital was always measured directly over pupils and was not necessarily the least interorbital distance. The eye was always measured as bony orbital length. Width of rear of head was measured at the junction of the mandibular and main lateral lines. The snout and upper-jaw measurements were taken with mouth closed, or if open, the mouth was forced closed prior to measurement. Anal-base-to-pelvic-base measurement was made only on undistorted specimens. The lips were measured vertically. Soft (or articulated) ray counts were recorded as the actual number minus one of separate rays distal to the body mass. The genus *Paraclinus* frequently has only one soft ray in the dorsal fin, which was recorded as one-half. In the grand total of dorsal rays in that genus the actual number of rays was recorded. If rays were branched, the caudal ray count was recorded as the number of branched rays plus 2; or if unbranched, the longest and stoutest rays plus 2. Scale counts from the dorsal and anal to the lateral line were made on the posterior diagonal from the insertion of the first spine. In this group of fishes, scales on the anterior diagonal vary more in num-

ber than on the posterior diagonal. Counts are listed by their extreme range followed by typical range in parentheses. Since the pelvic spine is usually short and closely bound to the first soft ray, it is not normally mentioned in the descriptions.

A modification of the graphic method proposed by Dice and Leraas (1936) was used to condense morphometric data obtained during the investigation. This method[3] is illustrated in Graph 1. The typical condition is shown by example "a." The base line indicates extreme range. The mean is indicated by a small line which projects upward. The solid area is the extent of 2 standard errors on each side of the mean. The hollow area delimits one standard deviation on each side of the mean. Example "b" illustrates a case in which a standard deviation on one side of the mean is more extreme than the extreme range for the sample. Example "c" shows a case in which 2 standard errors on one side of the mean are more extreme than the extreme range. In this example, the 2 standard errors on that side are shown by hatching. In some cases large numbers of specimens were not available.



GRAPH 1. Examples of graphic method used to present morphometric data. For explanation see text.

Example "d" illustrates a case in which only 4 specimens were available, causing 2 standard errors to equal one standard deviation. Example "e" shows a similar population in which one standard deviation exceeds the extreme range on one side. In this case, as in example "c," the two standard errors on one side are shown by hatching. If the population is yet smaller the standard deviation is exceeded by 2 standard errors. In this case the range of the 2 standard errors is hatched and covers the range of the standard deviation as shown in example "f." The statistical work in this paper has followed formulas and tables given by Snedecor (1946). [A critique of this graphical method, especially for comparison of small samples of disproportionate numbers is given by Simpson and Roe (1939, pp. 316-321)—Editors.]

Many specimens examined are at several museums. The following abbreviations for these museums are used: SU—Stanford Natural History Museum; CAS—California Academy of Sciences; USC—Hancock Foundation, University of Southern California; CNHM—Chicago Natural History Museum; UMMZ—University of Michigan Museum of Zoology; TNHC—Texas Natural History Collection; USNM—United States National Museum; NYZS—New York Zoological Society; SBSC—Santa Barbara State College; UCLA—Zoological Collections of University of California at Los Angeles; and RUC—Rhodes University College.

Many Latin-American localities discussed in text are shown in Maps 1-2.

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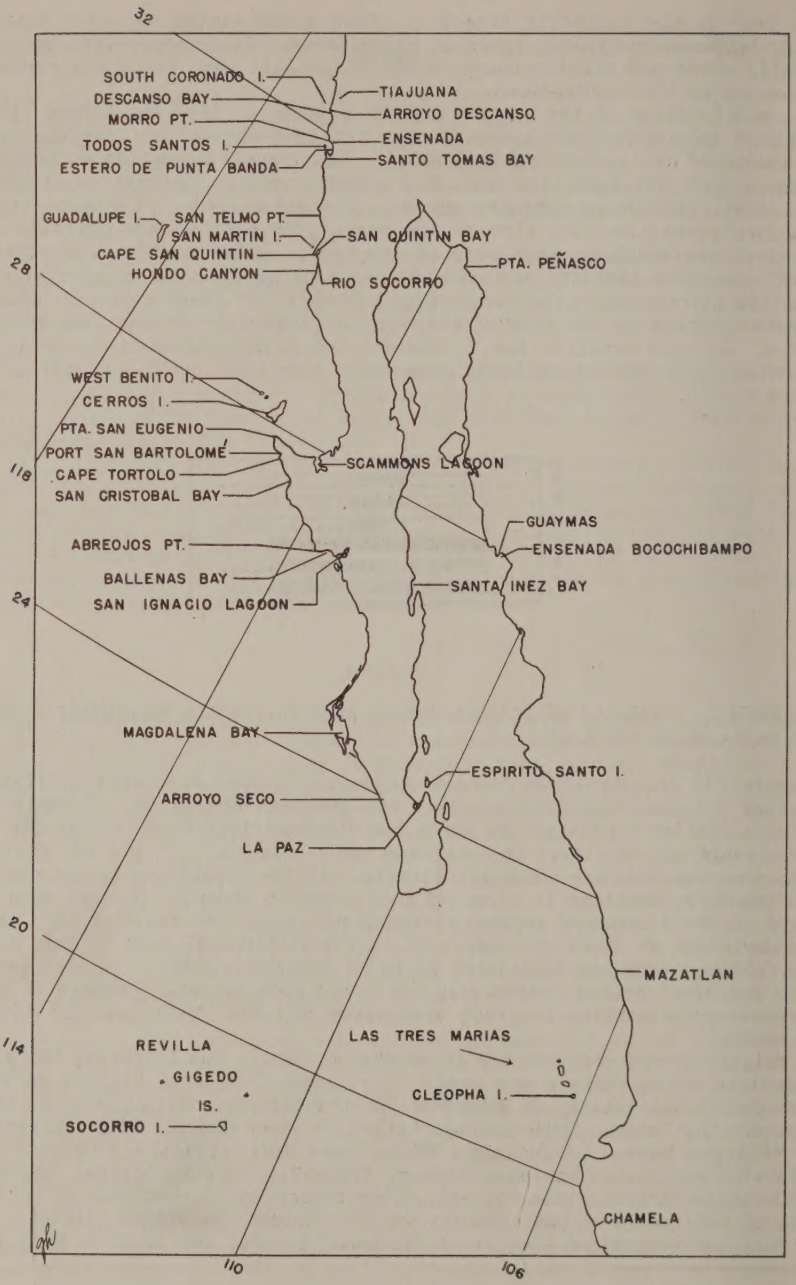
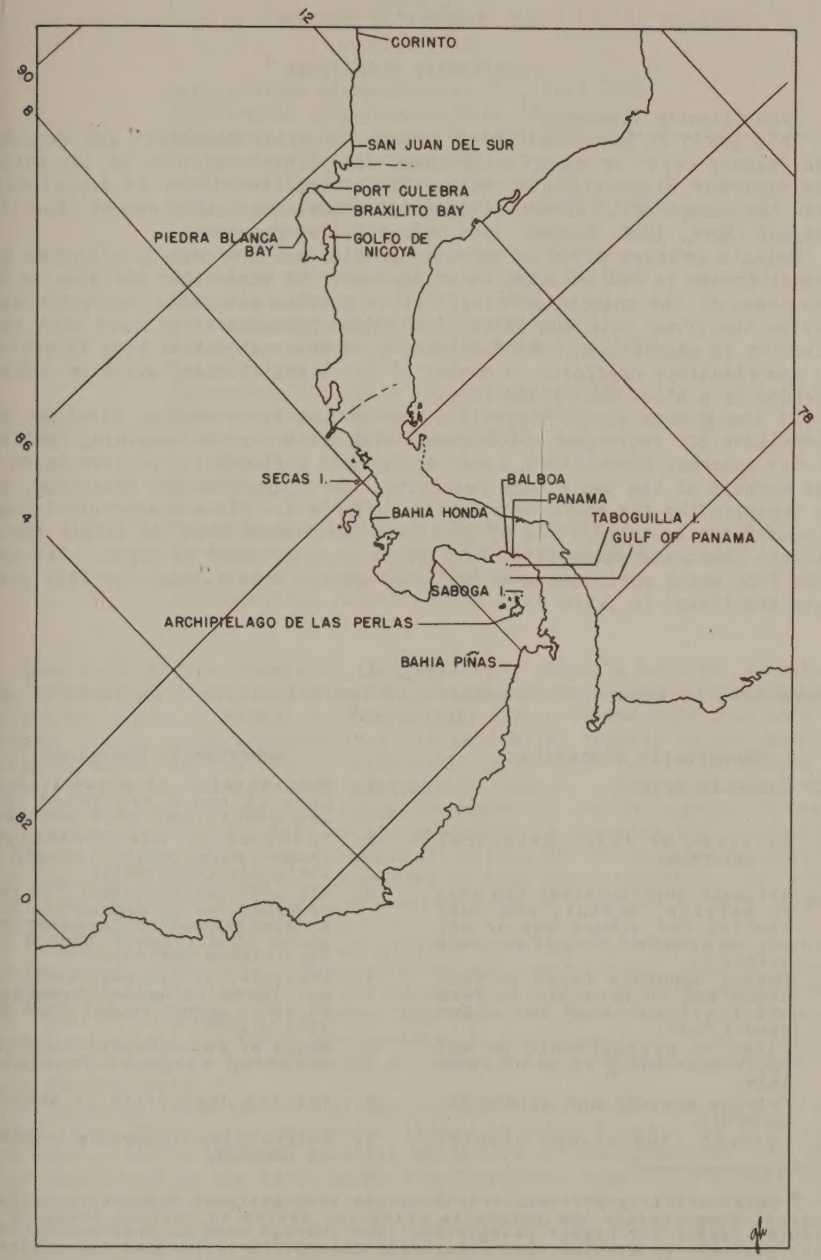
[3] Developed by the author jointly with Carl L. Hubbs.



MAP 1. Certain localities on the Pacific coast of northern Mexico mentioned in the text.



MAP 2. Certain localities on the Pacific coast of Central America mentioned in the text.

II. SYSTEMATIC SECTION

Superfamily BLENNIICAE [4]

Type *Blennius* Linnaeus.

This group is here restricted to the "tropical blennies" and excludes the "blenny eels" or superfamily Zoarcicae. In the opinion of the author the suborder Blennioidea of Regan (1912, modified 1929) is diphyletic. With the exception of Jordan (1923) (see below) most other recent classifications (Berg, 1940, Norman, 1931, etc.) follow Regan.

Regan's primary division of the Blennioidea into the Cliniformes and Blenniiformes is not believed to be correct. He based this division on the stoutness of the suborbital ring. It is granted that this character will divide the group into two units, but other characters indicate that this division is superficial, and furthermore, a weak suborbital ring is present in *Anarrhichthys ocellatus*, a member of his Blenniiformes, which he characterized by a stout suborbital ring.

If the genera which Regan included in the two families Clinidae and Blenniidae are regrouped and compared with those in the remaining families of his suborder Blennioidea, a more acceptable phylogenetic picture appears. The members of the two groups resulting, the Blenniicae and Zoarcicae, may be separated by the characters listed in Table 1. These characters in combination are believed to be of greater significance than the single inconsistent character (suborbital ring stout or weak) used by Regan. The species from which specimens were skeletonized and were studied for this analysis are listed in Table 2.

TABLE 1

Characters to separate the members of the Blenniicae from those of the Zoarcicae[5]

Superfamily Blenniicae	Superfamily Zoarcicae
1. Suborbitals 4.	1. Suborbitals, if present, 6 or more (1 and 2 are fused in a few genera but show suture).
2. Thirteen or fewer principal caudal rays.	2. Thirteen or more principal caudal rays (unless caudal is obviously degenerate).
3. All soft (articulated) fin rays in pelvics, dorsal, and anal simple; the others may or may not be branched but, if so, only twice.	3. All soft (articulated) fin rays branched, or so degenerate that articulations are greatly reduced (i.e., fewer than 5 articulations per ray).
4. Dorsal hypurals fused to each other and to urostyle to form chief articulation for upper caudal rays.	4. Urostyle, if present, small and not fused to dorsal hypurals to which upper caudal rays are articulated.
5. Wings of parasphenoid do not reach descending wings of frontals.	5. Wings of parasphenoid reach descending wings of frontals.
6. Pelvics present and seldom degenerate.	6. Pelvics degenerate or absent.
7. Lateral line always simple.	7. Lateral line frequently branched or complex.

[4] While awaiting official action by the International Commission on Zoological Nomenclature the author is using the system of endings proposed by Stenzel (1950) for higher categories. The endings used in this paper, that were proposed by Stenzel, are: Ini—subtribe; idi—tribe; and icae—superfamily.

[5] Many of these characters were discovered simultaneously by Mr. Norman J. Wilimovsky and the author; the former has kindly permitted my use of this information.

TABLE 2
Species represented by skeletal material studied in the analysis of the superfamilies

Epigeichthys atropurpureus (Kittitz) 1858
Anoplarchus purpurescens Gill 1861
Cebedichthys violaceus (Girard) 1854
Ptilichthys goodei Bean 1881
Anarrhichthys ocellatus Ayres 1855
Xererpes fucorum (Jordan and Gilbert) 1880
Lumpenus anguillaris (Pallas) 1811
Furcinanus diapterus (Gilbert) 1892
Scytalina cerdale Jordan and Gilbert 1880
Ronquilus jordani (Gilbert) 1889
Xnierpes macrocephalus (Günther) 1861
Paraclinus integripinnis (Rosa Smith) 1880
Malacoctenus sp.
Labrisomus philippii (Steindachner) 1866
Heterostichus rostratus Girard 1854
Gibbonsia elegans (Cooper) 1864
Tripterygion sp.
Neoclinus sp.
Neoclinus blanchardi Girard 1858
Hypsoblennius gentilis (Girard) 1854
Micropterus punctulatus (Rafinesque) 1819
Lepibema chrysops (Rafinesque) 1820
Acanthoclinus fuscus Jenyns 1841

Some doubt arises concerning the validity of Regan's suborder Blennioidea. His chief delimiting character (dorsal and anal basals each attached to its own neural or haemal spine) well may have occurred more than once in fishes. It is to be expected that fin rays might readily become segmentally arranged, as they are, if each basal is attached to its own neural or haemal spine; and this is true in *Ronquilus jordani*, a member of his Trachinoidea, and in *Acanthoclinus fuscus*, a member of his Percoidea. Regan's second characteristic (wings of the parasphenoid reaching the descending wings of the frontals) is not consistent within his Blennioidea as none of the tropical blennies appear to conform to this characteristic. The wings also meet in *Ronquilus jordani*, a species which is supposed to have separated frontals and parasphenoids.

Jordan's (1923) classification divides the order Jugulares into several series, among which are the Blenniiformes and Zoarciformes. Jordan did not state his reasons for such a division, but in his series Blenniiformes the families Clinidae, Blenniidae, Emblemariidae, Runulidae, and Chaenopsidae include all the forms here included in the Blenniicae. The remaining families in Jordan's Blenniiformes are here joined with the Zoarciformes to form the Zoarcicae.

It seems unlikely that one of the two superfamilies was derived from the other. The first three characters listed in Table 1 under the Zoarcicae are more primitive than the parallel characters of the Blenniicae; the last four characters in the table under the Zoarcicae, however, are more specialized than the parallel characters of the Blenniicae. This almost-equal distribution of primitive characters between the two groups suggests that neither has been derived from the other, although it does not eliminate the possibility of origin from a common ancestor.

The Zoarcicae seem to resemble members of the Trachinicae closely; specimens of the bathymasterid *Ronquilus jordani* agree with the Zoarcicae in

the first five characters listed in Table 1. Thus, we may assume that th blenny eels were derived from a trachinoid-like ancestor and might better be included with those fishes either as a superfamily under the Percina o more properly as a suborder characterized by the wings of the parasphenoi reaching the descending wings of the frontals. This group would includ the uranoscopoid fishes and possibly the ophidioids as well. As this pape deals with the Blenniicae, the Zoarcicae will not be discussed further ex- cept to remark that a reduction in number of families recognized by Jorda (1923) is indicated.

The origin of the superfamily Blenniicae is still more obscure. Fro the information available it seems possible that the group was derived fro a more generalized serranid-like perciform fish. Except for certain spe- cialized genera, the blennies resemble or approach serranids in having a robust body and the parasphenoid and frontals separated. The blennies ma be separated from the percoids on the basis of the unbranched rays in th dorsal, anal, and pelvic fins, and the jugular position of the pelvics i the former.

The superfamily Blenniicae may be divided into four families: Clinidae Pterygocephalidae (see description below), Tripterygiidae, and Blenniidae

KEY TO THE FAMILIES OF THE BLENNIICAE

1a. Spinous rays in anal fin 3; pelvic fins thoracic; heavy ridges in cen ters of scales; branchiostegal rays 5; Eocene fossil..... .....PTERYGOCEPHALIDAE (p. 50
1b. Spinous rays in anal fin 2; pelvic fins jugular; no heavy ridges i centers of scales; branchiostegal rays 6 or 7; recent forms.
2a. Lateral line canals on suborbital ring and preopercle not covered b bone; first gill arch united to operculum by a membrane; no cirri o nape; scales usually ctenoid; pectoral rays usually branched; cauda rays always branched.....TRIPTERYGIIDA
2b. Lateral line canals on suborbital ring and preopercle covered by bone first gill arch not united to operculum by a membrane; cirri usuall present on nape; scales not ctenoid; pectoral rays never branched caudal rays frequently unbranched.
3a. Suborbital ring weak; lachrymal expanded anteriorly but not extendin to middle of eye; other 3 suborbitals weak, deeper than wide; scale present, imbricate or not.....CLINIDAE (p. 54
3b. Suborbital ring stout; lachrymal extended posteriorly to point belo middle of eye or farther; other 3 suborbitals stout, wider than deep scales absent except in *Neoclinus*, which has small, nonimbricat scales.....BLENNIIDA

Family PTERYGOCEPHALIDAE, new

The genus *Pterygocephalus* Agassiz (1839), frequently considered a clin id, is here removed from that family because of the following: 3 spinou rays in anal fin; thoracic pelvics; heavy ridges on scales; and reduce number of branchiostegal rays (5 against 6). This genus of fossil fishe is believed to be the sole known representative of a new family, the Ptery gocephalidae, which I place within the Blenniicae with grave reservations It resembles the latter rather than the "blenny eels" in general body shape It differs from the Percicae by having only one dorsal and anal basal pe segment and by the absence of branched fin rays. The genus is in many way intermediate between the percoids and blennioids, having the segmental an unbranched fin rays of a blennioid and the 3 anal spines and thoracic pel

rics of the percoids. It is not, however, on the main line of blenny evolution, since the long, separated spine on the nape and heavy scale ridges are specializations.

Phylogeny of the Blenniicae

The suggested phylogenetic picture of the superfamily Blenniicae as well as its position in the classification is shown in Figure 1. The first family to depart from the ancestral blennioid stalk is believed to have been

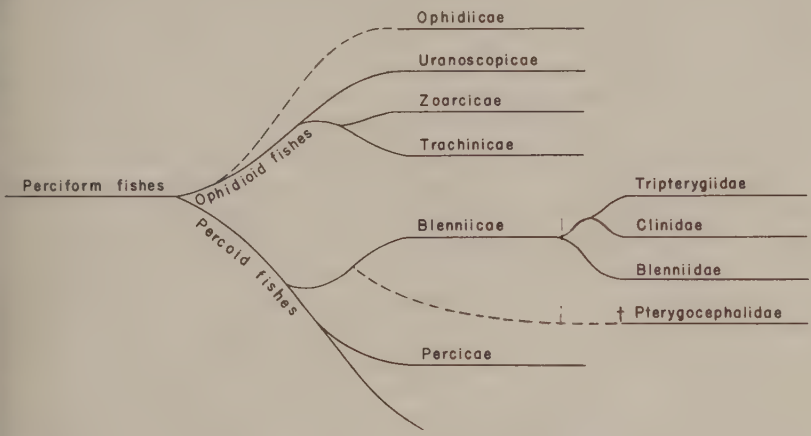


FIG. 1. Proposed systematic position and phylogeny of the main groups of the superfamily Blenniicae.

the Pterygocephalidae, which has many percoid characters. This family, because of its intermediate position between the Percicae and Blenniicae, demonstrates a closer relationship between the blennies and the typical perch-like fishes than was previously suspected. The early origin of the Pterygocephalidae is indicated by its fossil occurrence in the Eocene only. The Blenniidae were perhaps the next to diverge. Because of the flexible suborbital ring and of the large, imbricate scales in some members of both clinids and tripterygiids, these families are thougnt to be more closely related to each other than is either to the Blenniidae. Although the latter family is thought to have diverged from the main stalk of the superfamily early, all of the living forms are specialized in the high, anteriorly located eyes and the absence of imbricate scales in all species. Neither characteristic is typical of the perciform fishes. Members of the family Clinidae have a rounded or compressed body shape which is more typical of the percoid fishes than is the depressed body of the tripterygiids.

The geologic time of origin of the superfamily Blenniicae is obscure for lack of fossil evidence, which may be due to the development of the group in the warm seas of the New World (see below), in the deposits of which few fossil specimens have been found. The superfamily probably originated before the Eocene as the known specimens of the Pterygocephalidae are from Upper Eocene formations. Since this is a very specialized family, it probably branched off from the main stem of the Blenniicae earlier. Despite the specializations, the Pterygocephalidae closely resemble the Percicae and probably were derived shortly after the Blenniicae and Percicae diverged.

The detailed phylogenetic discussion of the Blenniicae in this sect is restricted for the following reasons: the Pterygocephalidae are rep sented by only one known species; the Tripterygiidae are too diversif and too little known for any attempt at a phylogenetic grouping or for termination of the primitive members of the family on the basis of ava able information; and the Clinidae are discussed in detail under the fam heading. Only the family Blenniidae remains to be discussed. An outl of the author's ideas on blenniid classification, which will be elabora in a later paper, is given below.

It is highly probable that the Blenniicae originated in the warm seas the New World, where all living families have representatives. This pothesis is supported by the distribution of the primitive members of Blenniidae and Clinidae (see below and p. 54), the only families which well enough known to determine primitive types.

The Chaenopsinae are thought to be the most primitive subfamily of Blenniidae because all members have conical teeth. The fishes of the ge *Neoclinus* Girard (1858) have scales and a lateral line, characterist which show this genus to be the most primitive in the subfamily.

Although the majority of the members of the Blenniidae are Indo-Pacif genera of the most primitive subfamily, the Chaenopsinae, except for *N clinus*, are exclusively from the warm seas of the Americas. The fam probably branched off from the main blenny stock there, and shortly the after the family again divided. The Chaenopsinae remained in the Americ The other members of the family migrated to the Indo-Pacific; from th they then branched out, formed several other major groups, and soon ente all of the tropical seas. The Chaenopsinae, which remained in the Americ soon divided into four tribes: the Emblemariidi, Chaenopsidi, Stathmor idi, and Neoclinidi. The first three did not leave the tropics. The N clinidi migrated northward to the coasts of Baja California and Californ There one species, *Neoclinus bryope* = *Zacalles bryope* Jordan and Sny (1903), split off from the primitive stock and, during an interval betw ice ages, probably migrated through the Aleutians to Japan. The other m bers of the genus remained in Californian waters.

Although the two assumedly most primitive genera of the Blenniicae, *N clinus* and *Calliclinus*, do not range in the warm seas of the New Worl thought to be the area where the family originated—they are found to north and south of it. If either of their respective ranges, Califor and Chile, was actually the location of the family's origin, the ot primitive type would have had to migrate a considerable distance. The c ter of distribution of the most primitive subfamily of both the Blennii and the Clinidae seems to have been the American warm seas.

OUTLINE OF THE CLASSIFICATION OF THE CLINIDAE

A large number of new taxonomic groupings is proposed in this pap So that the reader may know what fishes are included under each group, following outline of classification of the family shows the principal t onomic conclusions reached in the family Clinidae:

Family Clinidae Regan 1912
 Subfamily Labrisominae, new
  Tribe Mnierpidi, new
   Genus MNIERPES Jordan and Evermann 1896
    Mnierpes macrocephalus (Günther) 1861
     Mnierpes macrocephalus macrocephalus (Günther) 1861
     Mnierpes macrocephalus catherinae, new subspecies

Genus DIALOMMUS Gilbert 1891 (=EMMNION Jordan; =CROCKERIDUS Clark)
Dialommus fuscus Gilbert 1891 (=*bristolae* Jordan; =*odysseus* Clark)
Tribe Paraclinidi, new
Genus AUCHENISTIUS Evermann and Marsh 1899
Genus PARACLINUS Mocquard 1889
Paraclinus altivelis (Lockington) 1881
Paraclinus altivelis altivelis (Lockington) 1881
Paraclinus altivelis sini, new subspecies
Paraclinus monophthalmus (Günther) 1861
Paraclinus mexicanus (Gilbert) 1904
Paraclinus mexicanus mexicanus (Gilbert) 1904
Paraclinus mexicanus cleophensis, new subspecies
Paraclinus beebei, new species
Paraclinus integripinnis (Rosa Smith) 1880
Paraclinus integripinnis integripinnis (Rosa Smith) 1880
Paraclinus integripinnis zacae, new subspecies
Paraclinus walkeri, new species
Genus EXERPES Jordan and Evermann 1896
Exerpes asper (Jenkins and Evermann) 1889
Exerpes asper asper (Jenkins and Evermann) 1889
Exerpes asper magdalenensis, new subspecies
Exerpes asper earli, new subspecies
Tribe Starksiidi, new
Genus STARKSIA Jordan and Evermann 1896
Starksia cremnobates (Gilbert) 1890
Genus BRANNERELLA Gilbert 1900
Tribe Cryptotremidi, new
Genus ALLOCLINUS C. L. Hubbs 1927
Alloclinus holderi (Lauderbach) 1907
Genus CRYPTOTREMA Gilbert 1890
Cryptotrema corallinum Gilbert 1890
Tribe Labrisomidi, new
Subtribe Calliclinini, new
Genus AUCHENIONCHUS Gill 1860
Auchenionchus variolosus (Cuvier and Valenciennes) 1836
Auchenionchus microcirrhis (Cuvier and Valenciennes) 1836
Auchenionchus peruvianus (Cuvier and Valenciennes) 1836
Genus CALLICLINUS Gill 1860
Calliclinus geniguttatus (Cuvier and Valenciennes) 1836
Genus MYERSICHTHYS, new
Myersichthys guttulatus (Cuvier and Valenciennes) 1836
Myersichthys crinitus (Jenyns) 1841
Subtribe Labrisomini, new
Genus MALACOCTENUS Gill 1860
Subgenus MALACOCTENUS Gill 1860
Malacoctenus zonifer (Jordan and Gilbert) 1882
Malacoctenus afuerae (Hildebrand) 1946
Malacoctenus zonogaster (Heller and Snodgrass) 1903
Subgenus ACTEIS Jordan 1904
Genus LABRISOMUS Swainson 1839
Subgenus LABRISOMUS Swainson 1839
Labrisomus xanti (Gill) 1860
Labrisomus philippii (Steindachner) 1866
Labrisomus jenkinsi (Heller and Snodgrass) 1903
Subgenus ERICTEIS Jordan 1904
Subgenus ODONTOCLINUS Reid 1935
Labrisomus dendriticus (Reid) 1935

Subfamily Clininae Gill 1885
Tribe Clinidi, new (=Family Clinidae J. L. B. Smith 1946)
Subtribe Clinini, new (=Subfamily Clininae J. L. B. Smith 1946)
Genus CLINUS Cuvier 1817 (=OPHTHALMOLOPHUS Gill 1860)
Clinus agilis J. L. B. Smith 1931
Clinus anne (J. L. B. Smith) 1948
Clinus venustris Gilchrist and Thompson 1911
Clinus acuminatus (Bloch and Schneider) 1801
Clinus helenae (J. L. B. Smith) 1946
Clinus latipinnis Cuvier and Valenciennes 1836
Genus CLINETRACHUS Swainson 1839
Clinetrachus argentatus (Risso) 1810
Clinetrachus superciliosus (Linnaeus) 1758
Clinetrachus robustus (Gilchrist and Thompson) 1911
Subtribe Blennioclinini, new (=Subfamily Myxodinae Smith 1946)
Genus SMITHICHTHYS, new
Smithichthys fucorum (Gilchrist and Thompson) 1911
Subtribe Xenopoclinini, new (=Subfamily Xenopoclininae Smith 1949)
Tribe Myxodidi, new
Genus MYXODES Cuvier 1829
Myxodes cristatus Cuvier and Valenciennes 1836
Myxodes viridis Cuvier and Valenciennes 1836
Myxodes schmitti, new species
Genus HETEROSTICHUS Girard 1854
Heterostichus rostratus Girard 1854
Heterostichus rostratus rostratus Girard 1854
Heterostichus rostratus guadalupensis, new subspecies
Genus GIBBONSIA Cooper 1864
Gibbonsia metzi C. L. Hubbs 1927
Gibbonsia metzi metzi C. L. Hubbs 1927
Gibbonsia metzi ferventer, new subspecies
Gibbonsia norae, new species
Gibbonsia montereyensis C. L. Hubbs 1927
Gibbonsia montereyensis montereyensis C. L. Hubbs 1927
Gibbonsia montereyensis vulgaris, new subspecies
Gibbonsia erythra, new species
Gibbonsia elegans (Cooper) 1864
Gibbonsia elegans elegans (Cooper) 1864
Gibbonsia elegans velifera, new subspecies
Gibbonsia elegans erroli, new subspecies
Gibbonsia elegans rubrior, new subspecies

FAMILY CLINIDAE

Type *Clinus* Cuvier.

This family may be distinguished from the other members of the Blennii by the following: presence of scales; weak and flexible suborbital ri covered lateral line canals on head; absence of branched rays in pecto fins; and absence of ctenii on scales. Jaw teeth conical in all members this family. Most species have a patch of cirri over each anterior nost and orbit.

Phylogeny of the Clinidae

The more primitive of the two clinid subfamilies is thought to be Labrisominae because of the larger scales in all species and the occurre

of branched caudal rays in members of two of the five tribes, Labrisomidi and Cryptotremidi. (The fishes of the other subfamily, the Clininae, have embedded scales, and apparently none have branched fin rays.) Because the first three dorsal spines are soft and the number of cirri on the head is reduced, the Cryptotremidi are not thought to be primitive. Only a few genera of the Labrisomidi have branched rays. These genera are considered to form a distinct subtribe, the Calliclinini. The type genus of this subtribe, *Calliclinus*, has four pelvic soft rays, a primitive characteristic which is believed sufficient cause to consider this genus the most primitive of the family. It does have one specialization—a third, median patch of cirri on the nape.

As stated above, the present distribution of the family Clinidae indicates that it (and the superfamily Blenniicae) originated in the warm seas of the New World.

Four of the five tribes of the Labrisominae, the more primitive subfamily of the Clinidae, are represented in tropical American marine waters: the Paraclinidi and Labrisomidi, more abundant here than elsewhere, and the Starksiidi and Mnierpidi, almost completely restricted to this region. Only the Cryptotremidi, composed of rock-inhabiting fishes found rarely off California and Baja California, are confined to colder water. Although the assumedly most primitive genus, *Calliclinus*, is not now from tropical waters, the fishes could readily have migrated the short distance to northern Peru.

Although no representatives of the subfamily Clininae are found in the warm seas of the Americas, those of the most primitive tribe, the Myxodidi (primitive because of the absence of an intromittent organ in the male), are found both to the north and south. It is assumed that the early members of this tribe either moved into temperate waters or became adapted to

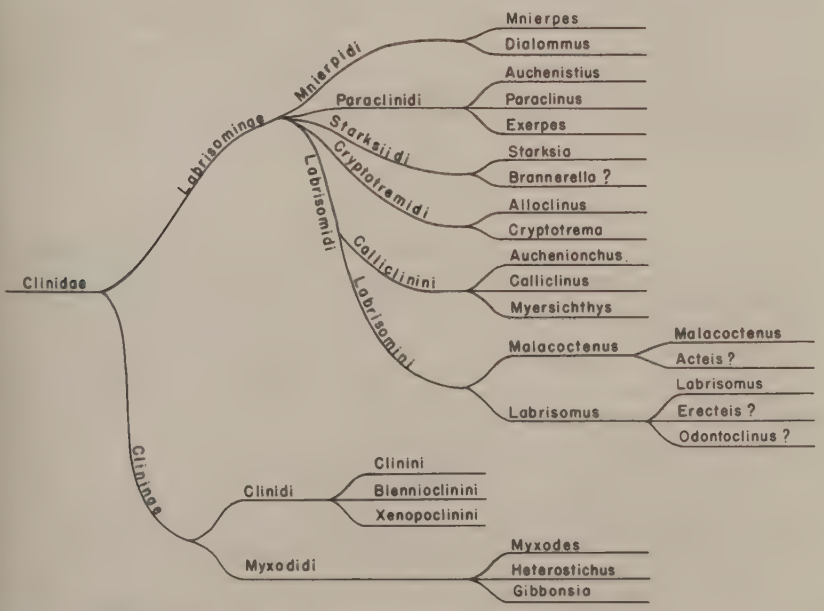


FIG. 2. Proposed phylogenetic arrangement of the Clinidae, including subfamilies, tribes and subtribes, and of the American genera and subgenera.

colder water during an ice age and moved into temperate waters during interglacial period. It is further assumed that the northern genera of t Myxodidi did not migrate directly from Panama to California but rather m grated first to Chile and from there to California during a later ice a after the Clinidi had evolved (see below). Some members of the Clininae southern South America were borne to South Africa, developed viviparity, a formed the Clinidi, which speciated very rapidly to develop the extensi fauna present there. From South Africa members of the Clinidi not only m grated back to South America but also to the Mediterranean and the Ind Pacific. Some members moved from the Indo-Pacific northward into Japane waters.

The proposed phylogenetic picture of the family is shown in Fig. Several of the names in the figure are tentative because of nomenclatori uncertainties.

KEY TO THE SUBFAMILIES OF THE CLINIDAE

1a. No hooklike projection on anterior surface of pectoral girdle; scal with radii only on anterior margins; scales never small and embedded. .....LABRISOMINAE (p. 5
1b. A distinct hooklike projection on anterior surface of pectoral girdl scales with radii on all margins; scales frequently small and embedd .....CLININAE (p. 10

Subfamily LABRISOMINAE, new

Type *Labrisomus* Swainson.

This entirely American subfamily may be distinguished from the Clinin by the above key. The majority of the members have distinct patches cirri over anterior nostril and orbit, as well as on nape. Most recogniz species have been taken from vegetation in rocky tidal pools, although sc are from rocks in deeper water or from shallow, heavily vegetated, san areas in bays.

KEY TO THE TRIBES OF THE SUBFAMILY LABRISOMINAE

1a. Pupil of eye with fleshy bar dividing it into anterior and posteri portion; head large and angular, with pronounced fleshy lips; anal spi short and stout with fleshy covering; head depressed..MNIERPIDI (p.
1b. Pupil of eye with no fleshy bar; head variable but not angular; an spines without fleshy covering; head compressed.
2a. Opercle with distinct spinous projection on posterior margin; dor soft rays fewer than 3; pectoral rays usually 13....PARACLINIDI (p.
2b. Opercle with no distinct spinous projection on posterior margin; d sal soft rays more than 5; pectoral rays 13 or more.
3a. Anterior portion of anal fin in males modified to serve as an int mittent organ; head cirri never branched; principal caudal rays branched; fewer than 42 lateral line scales.....STARKSIIDI (p.
3b. Anterior portion of anal fin in males not modified; head cirri usu ly branched (if not, principal caudal rays are branched); more t 40 lateral line scales.
4a. First 3 dorsal spines soft and flexible; principal caudal rays ways branched.....CRYPTOTREMIDI (p.
4b. First 3 dorsal spines sharp and rigid; principal caudal rays branc or unbranched.....LABRISOMIDI (p. 1

Tribe MNIERPIDI, new

Type *Mnierpes* Jordan and Evermann.

This small tribe is composed of two genera of rock-inhabiting fishes. They are "four-eyed" fishes; that is, they have a fleshy bar which runs vertically across the eye. This eye condition gives an indication of the habits of the group. At rest they lie at the edge of a tidal pool with the anterior "pair" of eyes above the surface and the posterior "pair" beneath the surface. They are "rock skippers" and are able to hop around on the rocks out of the water for some time. The eye structure has been investigated by Breder and Gresser (1939).

This group may be separated from the rest of the subfamily as follows: a fleshy bar runs vertically across pupil of eye; body elongate (depth 13% to 17% of standard length); anterior rays of spinous dorsal soft and flexible; anal rays all enlarged and fleshy at tips; no incisions in outline of spinous dorsal fin; head blunt with upper jaw projecting.

The two genera in this tribe are *Mnierpes* and *Dialommus*. They are separated geographically; *Mnierpes* being from the tropical Pacific coast of Central America and *Dialommus* from the Galapagos Islands. They may be distinguished by Table 3, Graph 2, and by the following key.

KEY TO THE GENERA OF THE TRIBE MNIERPIDI

1a. Anal spines 2; no cirri over eye; anal rays 22 to 23; total dorsal and anal rays 57 to 60; lateral line scales 45 to 51; head 24% to 29% of standard length.....MNIERPES (p. 57)

1b. Anal spine one; cirri over eye; anal rays 24 to 25; total dorsal and anal rays 64 to 66; lateral line scales 50 to 53; head 19% to 23% of standard length.....DIALOMMUS (p. 62)

TABLE 3

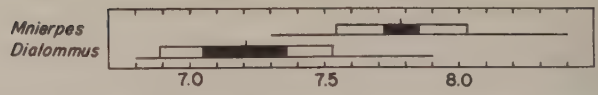
Proportional measurements in the Tribe Mnierpidi in percents of standard length

	Mnierpes	*Dialommus*
Head length	24-29	19-23
Snout length	5-8	4-6
Upper jaw length	9-13	7-11
Snout to dorsal	18-23	16-20
First dorsal spine length	4-6	5-7
Tenth dorsal spine length	7-9	6-8
Soft dorsal base length	21-25	22-26
First anal soft ray length	6-8	7-9
Longest pectoral ray length	19-24	18-23
Body depth	14-17	13-16

Genus MNIERPES Jordan and Evermann

Mnierpes Jordan and Evermann, 1896a, p. 468 (type species by original designation *Clinus macrocephalus* Günther).

This genus may be separated from all other known clinids by the combination of the following: a fleshy bar across pupil, 2 anal spines, and absence of cirri over eye. Since there is only one species, *macrocephalus*, a more complete description will be found under that heading.



GRAPH 2. Mnierpidi. Standard length into eye length, in percents, plu 0.2% for each 10 mm. of standard length.

Mnierpes macrocephalus (Günther)
For synonymy see subspecies description

Dorsal XXI to XXIII (XXII to XXIII), 10 to 12 (usually 11 to 12); ana II, 22 to 23; total dorsal and anal rays 57 to 60 (58 to 60); caudal 10 t 11 (11); pectorals 12 to 13 (13); pelvics I, 3; branchiostegal rays 6; la teral line scales 45 to 51 (46 to 49); scales from front of dorsal poster iorly to lateral line 2 to 9 (5 to 7); scales from front of anal posterior ly to lateral line 6 to 9 (6 to 7); gill rakers 2 + 5, all degenerate.

Head short, angular, and blunt; snout short. The thick, terminal, an projecting lips (0.8 of suborbital) have a slight incision at a point belo front of eye. Posterior end of maxillary ranges from a point below middl of eye to back of eye. The large, round eye is dorsad. A fleshy bar run vertically across eye, dividing it into an "anterior" and "posterior" eye The slightly larger "anterior" eye is more ventral than "posterior" eye Interorbital space narrow and concave. The rounded opercle has no spine o its posterior margin. Posterior margin of rounded preopercle is behin midpoint of postorbital bony length. Cirri absent over eye and scarce o nape, i.e., 1 to 3 (1 to 2), and on the anterior nostril, i.e., 5 to 1 (5 to 12), but the number increases with age. The longest are about one fifth the eye diameter.

Conical teeth present on premaxillaries, mandibles, and vomer. Those o jaws consist of a row of enlarged outer teeth and an inner band of smalle ones. The teeth towards posterior end of outer row become noticeably small er beyond the end of inner band. Vomer has a double row of small teeth.

The profile is concave as it rises steeply to eye, above which it be comes convex. Behind eye it rises slowly and extends straight to nape from which point it rises more steeply to first dorsal spine. It is leve along base of spinous dorsal, then declines to base of caudal fin. Cauda peduncle short and deep. Body rounded; head not noticeably wider tha body.

Dorsal spines all thin and flexible (more so in front) except the last which is stout and inflexible; sometimes next-to-last also stout. The fi originates over middle of opercle, and increases in height rapidly ove first 4 spines, then more slowly for about 8 more, then gradually decrease to last spine, which is noticeably shorter than the others, but not a short as first spine. Soft rays longer than the spines; the fifth th longest, the last 2 rays noticeably shorter. Tips of last rays exten slightly beyond base of caudal, but last ray not bound down to caudal pe duncle by a membrane except at its base. Distance between rays gradual increases from back to front. Membranes slightly incised, especially s between soft dorsal rays and first spines.

Caudal long and rounded.

Anal spines short and knoblike; first almost separated from seconc First spine goes 1.5 and 3.2 times into second spine and first soft ray re spectively. Soft rays enlarged and fleshy, and increase in size from fro to rear. Last two rays slightly shorter; last half-ray much shorter, no fleshy, and not attached to caudal peduncle by a membrane. Tips of longe posterior rays extend far beyond base of caudal (noticeably fartner than t tips of last dorsal rays). Membranes incised more than half.

The ninth ray of the long and bluntly rounded pectorals longest; lower rays much fleshier than upper; membranes range from slightly to moderately deeply incised from upper to lower. Second ray of short and fleshy pelvics longest; the first shortest. Membrane between first and second deeply incised, but that between second and third only slightly so.

Large, imbricate scales cover body. Head and all fins except very base of caudal naked. Anterior end of scaled area is outlined as follows: from anus anteriorly in a rather straight line to ventral base of pectoral, then behind base of that fin to upper margin of opercle, along that toward dorsal fin. A narrow, bare area along base of anterior dorsal spines, larger in *M. m. macrocephalus* than in the new subspecies, *M. m. catherinae*. The scales have radii only on their anterior margins (Fig. 3).

Lateral line runs straight back from upper end of opercle for about 15 scales, dropping gently to midline on about 8 scales, continuing straight to caudal peduncle. The anterior straight section has minute external pores in centers of scales, as shown in Fig. 4. The rest of lateral line scales consist of a pore at each end of a tube (Fig. 5). The typical lateral line canals on head have a single or double row of very minute pores.

Figure 3

Figure 4

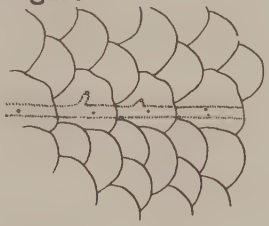
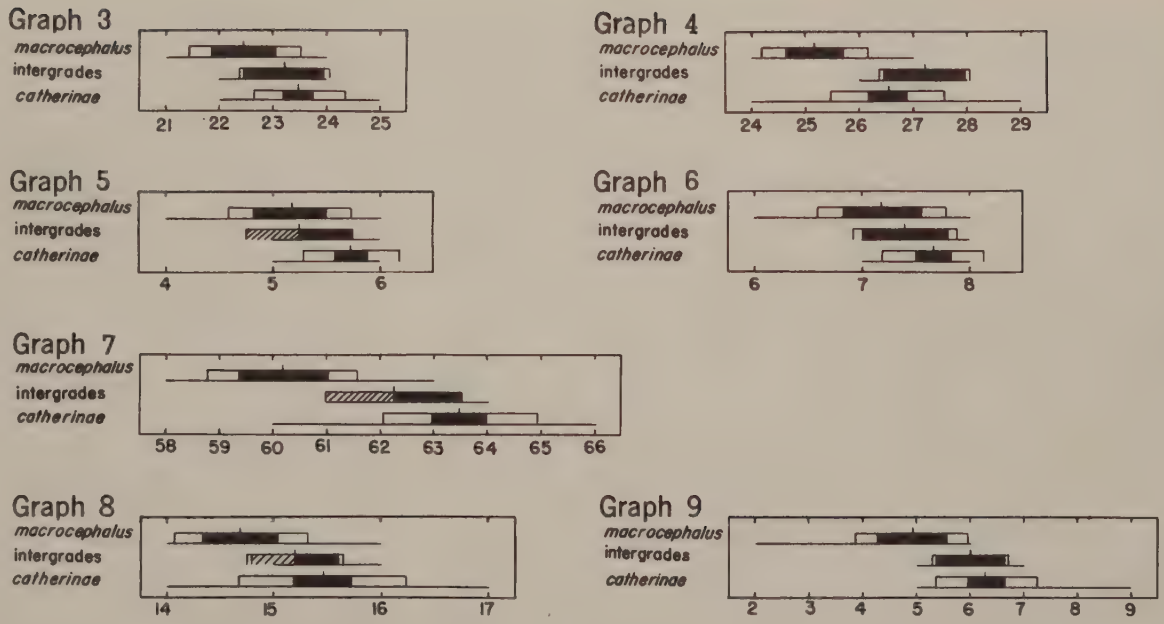


Figure 5

FIGS. 3-5. *Mnierpes macrocephalus*. Fig. 3. Body scale. Fig. 4. Anterior lateral line scales. Fig. 5. Posterior lateral line scales.

The following color pattern is described from alcohol specimens. Body slate gray with 6 blackish, irregular vertical bands. The 2 central bands more pronounced than those on each side. Bands fade out ventrally, and belly and breast are white. Dorsal fin membranes black in front gradually becoming lighter posteriorly until they are colorless between the dorsal soft rays; membranes between dorsal spines have light margin. Spines and rays have reddish-brown dashes, which form irregular, anterodorsal-posteroventral, thin stripes. Caudal rays similarly marked to form 5 vertical bands. Anal has same color pattern but is lighter anteriorly. Pectorals like caudal, with 6 reddish-brown vertical bars. Pectoral base reddish brown. Pelvics and pelvic base colorless. Head light slate gray above, with dark markings around lateral line pores. Cheeks and jaws covered by white mottlings with reddish-brown outlines. Ventral surfaces white. A dark mark on dorsal margin of branchiostegal membrane. The slate-gray eye has slate-blue pupil.

This species ranges from the Gulf of Panama to Corinto, Nicaragua. It is divided into 2 geographic subspecies, which intergrade near Bahia Honda, Panama; the 5 specimens from that locality are intermediate. Unfortunately, only 15 specimens of the southern subspecies, *M. m. macrocephalus*, and 42 of the northern subspecies, *M. m. catherinae*, were examined. This is a small number of specimens upon which to base a new subspecies, but the author believes that the data validate the new form. The single Galapagos



GRAPHS 3-9. Subspecies of *Mnierpes macrocephalus*. Graph 3. Standard length into length of base of dorsal soft rays, in percents. Graph 4. Standard length into head length, in percents. Graph 5. Standard length into first dorsal spine length, in percents. Graph 6. Standard length into first anal soft ray length, in percents. Graph 7. Standard length into sum of: length of dorsal soft ray base, head length, first dorsal spine length and first anal soft ray length, in percents. Graph 8. Standard length into body depth at first anal spine, in percents. Graph 9. Scales from origin of dorsal diagonally to lateral line.

record is based on a Stanford specimen, uncatalogued at the time of the 1906 earthquake; many bottles were broken, and it is not impossible that its data became interchanged with that of another uncatalogued specimen. Since its characteristics agree with those of the Panamanian subspecies, *macrocephalus*, it is considered to have been collected around Panama. The members of both subspecies are tide-pool inhabitants which can and do remain out of water for considerable periods. They typically lie at rest along a vertical tide-pool wall with the "anterior pair" of eyes exposed for air vision and the "posterior pair" submerged for water vision.

Mnierpes macrocephalus macrocephalus (Günther)

Clinus macrocephalus Günther, 1861a, p. 266 (type locality Pacific coast of Central America, probably Panama; holotype in British Museum); 1861b, p. 373; 1868, p. 389, 442, pl. 69, fig. 2.—Jordan and Gilbert, 1882b, p. 377.—Boulenger, 1899, p. 4.

Mnierpes macrocephalus Jordan and Evermann, 1896a, p. 468; 1898, p. 2364.—Gilbert and Starks, 1904, p. 189.—Kendall and Radcliffe, 1912, p. 152.—Meek and Hildebrand, 1928, p. 933.—Jordan, Evermann, and Clark, 1930, p. 455.—Fowler, 1944, p. 228, 520.

Dialommus fuscus (nec Gilbert) Kendall and Radcliffe, 1912, p. 153 (Panama record only).—Meek and Hildebrand, 1928, p. 935 (Panama record based on Kendall and Radcliffe).

This subspecies will be distinguished from *M. m. catherinae* under that heading.

The following 15 specimens, from 38 to 108 mm., were examined: 6 from Perico Island, Gulf of Panama, one fathom, USNM 65576; 2 from Bahia Piñas, Gulf of Panama, USNM 102011; 2 from Taboguilla Island, Gulf of Panama, USNM 65577; one from Isla Saboga, Archipielago de las Perlas, Gulf of Panama, RUC; one from Islas Secas, Panama, USNM 102005; 2 from Panama, USNM 30956; and one from San Cristobal (Chatham) Island, Galapagos Islands (?), SU 25316.

The following 5 intergrades from Bahia Honda, Panama, were examined: USNM 94050 and SU 16190.

Mnierpes macrocephalus catherinae Clark Hubbs, new subspecies
Figure 6

In this subspecies the base of the dorsal soft fin rays (Graph 3), the head (Graph 4), and the first dorsal spine (Graph 5). are statistically longer than those of *M. m. macrocephalus*. The first anal soft ray is longer, on the average, in *M. m. catherinae* than in the typical subspecies, but this difference is of doubtful statistical validity (Graph 6). Since the specimens from Bahia Honda, Panama, are intermediate in all the above comparisons, except that of head length, they are considered as intergrades. When the sums of the above characters are compared in the 2 subspecies, the standard deviations of their percents of standard length do not overlap (Graph 7); the intergrades are again intermediate in this tabulation. Body depth at first anal spine is statistically greater in *M. m. catherinae* than in *M. m. macrocephalus* (Graph 8). The scales from insertion of dorsal fin to lateral line are statistically more numerous than in *M. m. macrocephalus* (Graph 9). In each of the last 2 characteristics the intergrades are intermediate.

Named *catherinae* after my wife, Catherine S. Hubbs.

The 42.5-mm. holotype (NYZS 28178) was collected by Dr. William Beebe

on the *Zaca* Expedition from Piedra Blanca Bay, Costa Rica, on February 4 1938. The following 41 specimens, from 42 to 102 mm., are designated a paratypes: 2 from San Juan del Sur, Nicaragua, CAS 20496; 3 from Corinto Nicaragua, SU 16191, 16195, and CNHM 51439; 8 from Port Parker, Costa Rica TNHC 412 and CAS 20497; 2 from Port Culebra, Costa Rica, CNHM 51433; 2 from Piedra Blanca Bay, Costa Rica, SU 16192, 16193, 16194, and NYZS 28152a 2 from Islas Negritas, Golfo de Nicoya, Costa Rica, USNM 151990 and 151991 and one from Braxilito Bay, Costa Rica, CAS 3991.

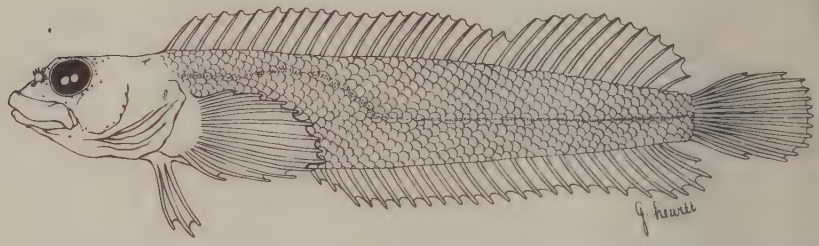


FIG. 6. *Mnierpes macrocephalus catherinae*, n. subsp. A 66-mm. specime from TNHC 412.

Genus DIALOMMUS Gilbert

Dialommus Gilbert, 1891, p. 452 (type species by original designation *Dia lommus fuscus* Gilbert).

Emmnion Jordan, 1897, p. 454 (type species by original designation *Emmni bristolae* Jordan).

Crockeridius Clark, 1936, p. 391 (type species by original designatio *Crockeridius odysseus* Clark).

This genus can be separated from all other known blennioids by the co bined presence of a fleshy bar across pupil, a single anal spine, and cir over eye. Since there is only one species, *fuscus*, a more complete d scription will be found under that heading.

Dialommus fuscus Gilbert

Dialommus fuscus Gilbert, 1891, p. 452 (type locality Galapagos Island holotype in U.S. Nat. Mus.).—Jordan and Evermann, 1898, p. 2868. Snodgrass and Heller, 1905, p. 418.—Kendall and Radcliffe, 1912, 153 (San Cristobal, i.e., Chatham, Island record).—Meek and Hild brand, 1928, p. 935 (description).—Breder and Gresser, 1939, p. 2 pls. 1, 2, figs. 1-3.

Emmnion bristolae Jordan, 1897, p. 454, pl. 55, fig. 1 (type locality Gal pagos Islands; holotype USNM 47578).—Jordan and Evermann, 1898, 2375.—Snodgrass and Heller, 1905, p. 418.—Herre, 1936, p. 396.

Crockeridius odysseus Clark, 1936, p. 391 (type locality Galapagos Islanc holotype CAS 2806).

Dorsal XXIV to XXV, 12 to 14 (12 to 13); anal I, 26 to 27; total dors and anal rays 64 to 66; caudal 11; pectorals 13; pelvics I, 3; branchi

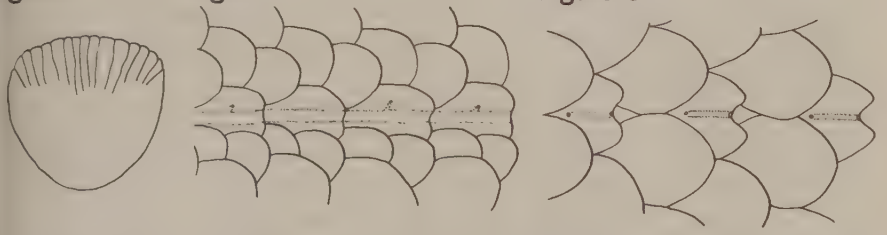
stegal rays 5 to 6 (6); lateral line scales 50 to 53 (50 to 52); scales from front of anal posteriorly to lateral line 5 to 10 (9 to 10); scales from front of dorsal posteriorly to lateral line 4 to 6 (5); gill rakers 2 + 6.

Head short and angular; snout short. Thick, terminal, and projecting lips almost twice suborbital. Lower jaw receding; upper jaw reaches posteriorly to a point below middle of eye. The round eye anterior and dorsad; divided in two by a vertical, fleshy bar; the slightly larger anterior half a little below posterior half. Opercle bears no spines. Posterior edge of the rounded preopercle behind midpoint of postorbital bony length. The minute cirri (one-fifth eye diameter) number from 0 to 2 on nape, 1 to 4 over eye, and 1 to 9 on anterior nostril.

Conical teeth present on premaxillaries, mandibles, and vomer. Those on mandible consist of a row of enlarged outer teeth and a large inner band of smaller teeth. The teeth towards the posterior end of outer row become noticeably smaller beyond end of inner band. Premaxillary similar except that outer row does not continue beyond inner band. The vomer has a few small teeth.

The profile is concave as it rises steeply to eye, then is convex from there to posterior margin of eye, beyond which it rises slowly and evenly to nape, followed by a steeper rise to the first dorsal spine. Profile level along base of spinous dorsal; it then drops gently to caudal base along soft dorsal rays. Caudal peduncle short and deep. Rounded body not noticeably thinner than head.

Figure 7 Figure 8 Figure 9



FIGS. 7-9. *Dialommus fuscus*. Fig. 7. Body scale. Fig. 8. Anterior lateral line scales. Fig. 9. Posterior lateral line scales.

Insertion of dorsal fin posterior to middle of opercle. All dorsal spines thin and flexible; the last stouter than the others but still flexible. Dorsal fin outline smooth; a slight rise from the first to fourth spines, then a leveling off as far as last 4, which are progressively shorter. Soft dorsal rays higher than dorsal spines; the height increases gently for the first 4 soft rays, then becomes level only to decrease more rapidly over the last 3. Tips of last rays reach to, or slightly beyond, base of caudal, and for half its length the last ray is attached by a membrane to caudal peduncle. The rays become progressively and evenly wider apart toward front of fin. Membranes between dorsal spines slightly incised; those between soft rays incised one-fifth.

Caudal long and rounded.

Anal spine short, rather stout, and inflexible. Rays thick and fleshy, but tapered to the tips. Anal spine contained 2.5 times in first soft ray. Ray-lengths gradually increase from front to rear, with only the last ray shorter. Tips of last rays extend beyond base of caudal (noticeably far-

ther than the dorsal rays); last ray not attached by a membrane to cauda peduncle. Membranes between rays incised two-thirds.

The ninth ray of the long and rounded pectorals the longest. Membrane all incised, but more deeply on the thicker lower rays. The short an blunt pelvics have fleshy rays; the second the longest, the first the short est. The membrane between the first and second deeply incised, that be tween second and third only slightly.

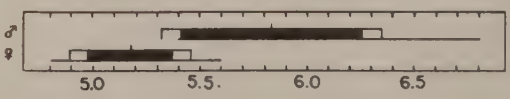
Scales large and imbricate. Head and all fins except extreme base c caudal naked. Anterior edge of the scaled area runs from anus toward lowe base of pectoral fin, where it turns dorsally to include the scaled base c that fin; above pectoral it runs along posterior margin of opercle to la teral line and from there in a straight line to second dorsal spine. Th scales have radii only on their anterior margins (Fig. 7).

Lateral line runs straight back from upper margin of opercle for abou 15 scales, then gradually drops to midline, on which it runs to caudal base The anterior straight section may have external pores on branch canals abo main canal (Fig. 8). The posterior section consists of a series of tube with pores at each end (Fig. 9). One or 2 rows of minute pores on eac side of each canal on head.

The following color description is from alcohol specimens. Body grour color reddish brown, lighter below, with 9 dark dorsal saddles, which fac out ventrally. Belly and anterior base of anal fin white. Dorsal reddish brown with a dark ocellus-like spot on membrane between second and thir spines. Soft rays of dorsal have spots which form anterodorsal-posterover tral, interrupted stripes. Caudal marked like soft dorsal, with 7 poster orly pointed, V-shaped bands. The reddish-brown color on anal become fainter anteriorly and proximally. Pectorals reddish brown with 5 darke bands across the rays. Pelvic bases dark red brown; the pelvics light Head similar to body, but lighter; with darker areas at upper posteric margin of opercle and along posterior edge of preopercle; ventrally, th reddish brown gradually fades to white.

This species is limited to the Galapagos Islands. The specimens fro the mainland listed by Kendall and Radcliffe (1912) as *Dialommus fuscus* ar *Emmnion bristolae* are presumed to be misidentified. Not enough specimer were available to determine whether there was any variation from island t island in the archipelago. These fishes are rock skippers like the *Anier pes*. They rest with the anterior "pair" of eyes above the surface of th water and the lower pair below and will leave the water at the least provo cation and hop about on the rocks.

The distance from eye to preopercle (taken on line of greatest postorbi tal bony length) is statistically greater in males than in females (Grap 10).



GRAPH 10. Secondary sexual dimorphism in *Dialommus fuscus*. Distanc from eye to preopercle on line of greatest bony postorbital length.

The following 27 Galapagos Islands specimens, from 40 to 71 mm., were e amined: 10 from Pinzon (Duncan) Island, CAS 2810 to 2818; 2 from Isabel (Albermarle) Island, SU 6409 and USNM 43406; three from San Cristobal (Cha ham) Island, SU 25315 and USNM 65475; one (the holotype of *Emmnion bris tolae*), USNM 47578; one from Fernandina (Narborough) Island, SU 2437 one from South Seymour Island, SU 37571; one from Darwin Bay, Tower Islan SU 37569; and 7 from Academy Bay, Santa Cruz (Indefatigable) Island, S 37570 and CAS 3536, 3560, 3561, 4508, 4509, and 4511.

Tribe PARACLINIDI, new

Type *Paraclinus* Mocquard.

This new tribe may be recognized easily by the presence of a spine on the opercle and the small number of soft dorsal rays (0 to 2); by 30 to 60 large scales along lateral line, and the few cirri: 0 to 10 on nape, 0 to 12 over eye, and one to 8 on anterior nostril. The species are all small (less than 70 mm. standard length). On the basis of existing data, all Pacific species appear to live in relatively shallow water; only *Paraclinus beebei* and *P. altivelis* have been taken from well below tide level.

Members of the tribe range beyond the area under discussion into the western Atlantic, and further studies will have to be made on the fishes of that area. They do not, however, occur in New Zealand because *Auchenopterus aysoni* Hector (1902) is referable to *Phillippsichthys* Whitley (1937) of Tripterygiidae, or in the Mediterranean since *Auchenopterus veranyi* (Filippi e Verany) (1859) is referable to the Clininae. In the Pacific all recorded specimens are from north of the equator. Although the majority of the species are tropical, some, especially *P. integripinnis*, reach temperate waters.

KEY TO THE GENERA OF THE PARACLINIDI

1a. Lateral line absent; dorsal spines 41 to 42; longitudinal scale rows more than 55.....AUCHENISTIUS (p. 66)

1b. Lateral line present; dorsal spines less than 40; longitudinal scale rows less than 50.

2a. Snout not greatly prolonged; cirri on nape and eye; scales on anterior segment of lateral line not consisting of a pore at each end of a tube; suborbital lateral line canal present.....PARACLINUS (p. 66)

2b. Snout greatly prolonged; no cirri on nape or eye; scales on anterior segment of lateral line consisting of a pore at each end of a tube; suborbital lateral line canal absent.....EXERPES (p. 90)

Genus AUCHENISTIUS Evermann and Marsh

Auchenistius Evermann and Marsh, 1899, p. 359 (type species by original designation *Auchenistius stahli* Evermann and Marsh).

Histioclinus Metzelaar, 1919, p. 157 (type species by original designation *Histioclinus veliger* Metzelaar).

This Atlantic genus does not enter the area under consideration and will not be discussed further.

Genus PARACLINUS Mocquard

Auchenopterus (nec *Auchenopterus* Agassiz, 1846, a catfish) Günther, 1861a, p. 275 (type species by monotypy *A. monophthalmus* Günther).

Cremnobates (nec *Cremnobates* Swainson, 1855, a mollusc) Günther, 1861b, p. 374 (substitute for *Auchenopterus* Günther; same type).

Acanthoclinus (nec *Acanthoclinus* Jenyns, 1841, a blenny) Mocquard, 1886, p. 18 (type species by monotypy *A. chaperi* Mocquard).

Paraclinus Mocquard, 1889, p. 41 (substitute for *Acanthoclinus* Mocquard; same type).

Corallicola Jordan and Evermann, 1898, p. 2369 (type species by original designation *Cremnobates marmoratus* Steindachner).

Tekla Nichols, 1922, p. 69 (type species by monotypy *Cremnobates fasciat*
Steindachner = *?Acanthoclinus chaperi* Mocquard).
Cremnotekla Whitley, 1940, p. 242 (substitute for *Auchenopterus* Günther
Cremnobates Günther; same type).

Dorsal XXVII to XXXIII, 0 to 1. Lateral line scales 31 to 40. Pector
rays almost always 13.

Head rather large, 28% to 36% of standard length; jaws equal or low
slightly projecting. There is considerable sexual dimorphism in length
maxillary; in males it reaches as far posterior as posterior border of e
in females to middle of eye (see next section for discussion). The rou
eye never enters dorsal profile. A spine on upper posterior margin of o
ercle. Posterior edge of preopercle located just anterior to midpoint
postorbital bony head length; its smooth posterior edge interrupted by
teral line pores. From one to 12 cirri on nape, over eye, and on anter
nostril.

Conical teeth present on premaxillaries, mandibles, vomer, and (only
males of *beebei*) on palatines. Those on the jaws always arranged in
outer row of enlarged teeth and an inner band of smaller teeth, with a
enlarged teeth scattered behind the band. Vomerine and palatine teeth
larged and in one or 2 rows.

Base of first dorsal spine above, or very close behind, posterior mar
of preopercle. First 3 spines more or less separated into a distinct
terior dorsal fin; however, if the membrane is separated, the separation
slight. Distance between third and fourth dorsal spines always great
than that between any other 2. First 3 spines thinner and sometimes mo
flexible than the posterior spines; third and fourth spines always shor
than those adjacent. Tips of last spines—and rays if present—always
tend beyond caudal base; for its entire length last ray is always bou
down by membrane to caudal peduncle and caudal base.

Caudal short and bluntly rounded.

The 2 anal spines similar to spines in main part of dorsal fin. Tips
last rays extend beyond base of caudal, the last ray more or less attac
by a membrane to caudal peduncle.

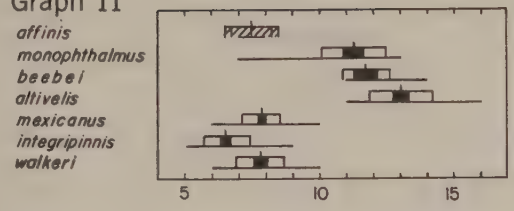
Pectorals bluntly pointed. Membranes more deeply incised ventrally t
dorsally. Membranes of the long and pointed pelvics limited in ext
since they are deeply incised and narrow between first 2 rays and alm
absent between second and third rays.

Scales large and imbricate. They cover caudal base and extreme base
caudal fin and anterior base of pectoral fin except in *beebei*, where
anterior pectoral base is naked in females and scaled only ventrally
males. Head, nape, and pelvic base naked. Scales have radii only on th
anterior margins.

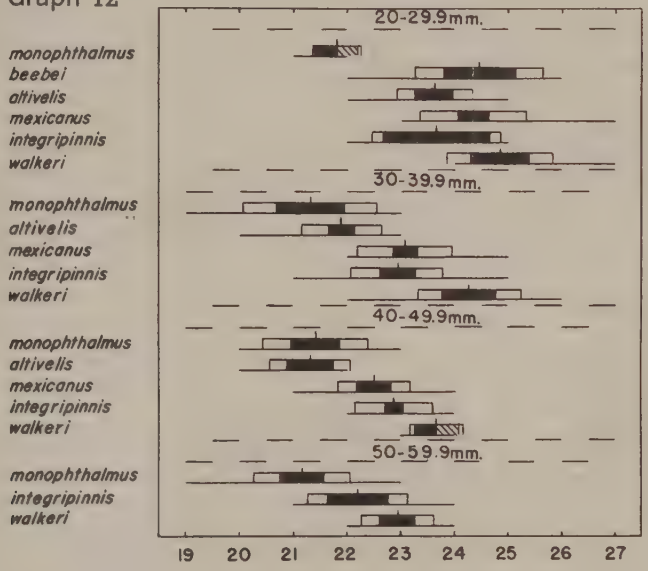
Lateral line extends in a gentle arc posteriorly for about one-third
length, then drops to midline, then runs straight to caudal base. The
terior segment has no visible external pores because each opening lies
der the next anterior scale. There may be vestiges of external pores
some species. The posterior scales have a pore at each end of a tube.
teral line canals on head complete, and each canal has at least a dou
row of pores (one on each side of canal).

This author agrees with Storey's (1940) solution of the nomenclator
puzzle and that *Paraclinus* is the oldest valid name. Division of the ge
into subgenera, such as that proposed by Jordan and Evermann (1898), is
indicated by this study of eastern Pacific forms. The species group *int*
ripinnis (see below) is not believed to merit subgeneric ranking.
amount of separation of the first 3 dorsal spines from the rest of the
varies greatly among the species of the genus, but more so between the
sexes of several of the species. When either sex is considered, there

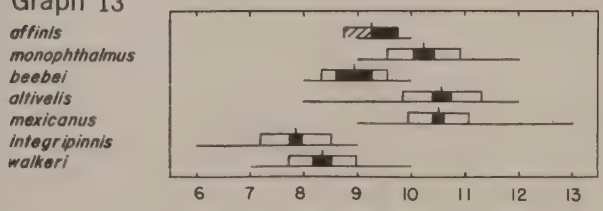
Graph 11



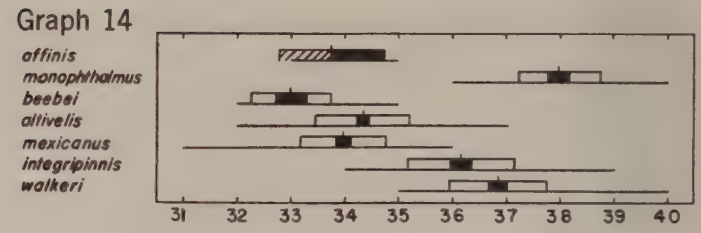
Graph 12

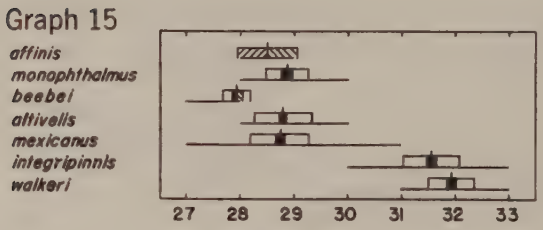


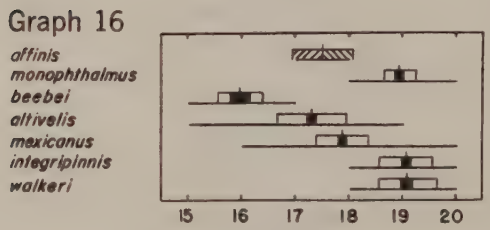
Graph 13

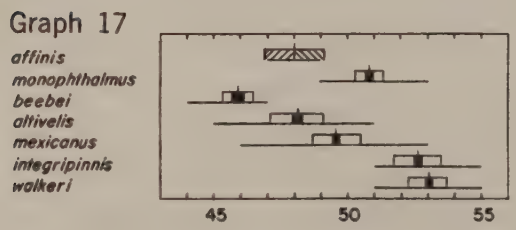


GRAPHS 11-13. Pacific species of *Paraclinus*. Graph 11. Standard length into first dorsal spine length, in percents. Graph 12. Standard length into snout-to-dorsal distance, by 10-mm. size groups, in percents. Graph 13. Standard length into tenth dorsal spine length, in percents.









GRAPHS 14-17. Pacific species of *Paraclinus*. Graph 14. Lateral l scales. Graph 15. Dorsal spines. Graph 16. Anal soft rays. Graph 17. of dorsal and anal fin rays.

nstant gradation from *monophthalmus* on one side to *integripinnis* on the her. The presence or absence of a dorsal soft ray is not even constant thin one species, since *mexicanus* has no soft ray in 10 specimens, one ft ray (called one-half in this paper) in 207 specimens, and 2 soft rays alled one in this paper) in one specimen. Obviously no one species should nge across a generic character in such a manner. Since only the Pacific ecies have been studied (except the form on the Caribbean coast of Panama ntatively called *affinis*), no definite phylogenetic conclusions can be awn. However, these six species seem to be arranged in two groups: (1) *onophthalmus, mexicanus, beebei,* and *altivelis* and (2) *integripinnis* and *alkeri*. It is obvious that *walkeri* has been derived recently from *integripinnis* or its precursor and differs from the former chiefly in the increased number of branchiostegal rays (7 against 6). The remaining four ecies cannot be grouped either including or excluding *integripinnis* and *alkeri* on the basis of the present data. Several characters are present hich will separate one or two from the rest, but in each case other characters will separate another group of species as readily. For instance, *eebei* and *monophthalmus* have no vestigal pores on the anterior lateral ne arc; *mexicanus* and *monophthalmus* usually have a soft ray present; *onophthalmus* and *altivelis* have the third and fourth dorsal spines separated by more than twice the distance between the fourth and fifth spines nd may have the first 3 spines completely separated; *mexicanus, integripinnis,* and *walkeri* have short first dorsal spines (less than 10% of standard length), that of *monophthalmus* is intermediate in length, while *beebei* nd *altivelis* have long first dorsal spines (more than 10% of standard ength); in *altivelis, integripinnis,* and *walkeri* the tips of the last anal ays extend farther posteriorly than do the tips of the last dorsal rays.

The Pacific species may be separated by Graphs 11 to 17 and by the following key.

Key to the Pacific Species of PARACLINUS

1a. Distance between third and fourth dorsal spines more than twice that between any 2 other dorsal spines; membrane behind third spine attached below midpoint of fourth dorsal spine, except in male *altivelis*.

2a. Posterior flaplike projections behind each scale except those on lateral line; tips of last anal rays extending farther posteriorly than tips of last dorsal rays; no dorsal soft ray.....*P. altivelis* (p. 72)

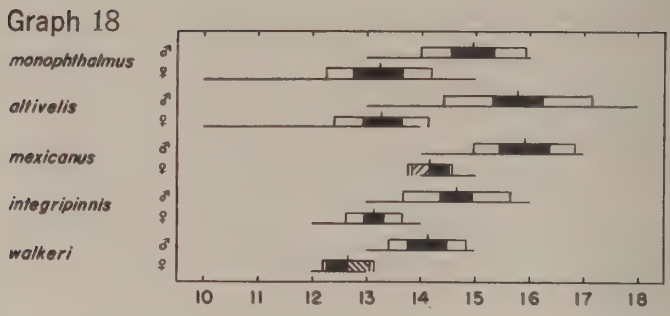
2b. No posterior flaplike projection behind scales; tips of last anal rays not noticeably posterior to tips of last dorsal rays; one dorsal soft ray.....*P. monophthalmus* (p. 76)

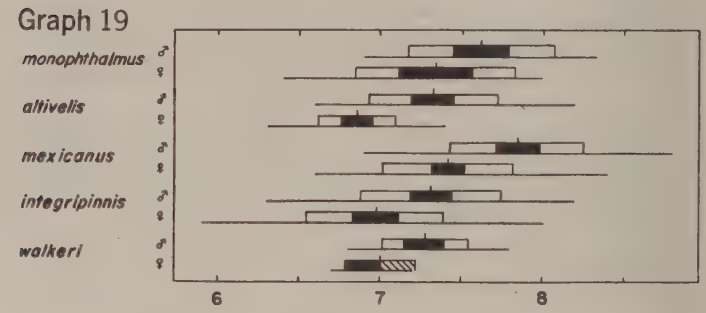
1b. Distance between third and fourth dorsal spines about 1.5 times that between any 2 other dorsal spines; membrane behind third spine attached beyond midpoint of fourth dorsal spine.

3a. Last dorsal ray (usually soft) bound down by membrane slightly more to caudal fin than to caudal peduncle; third pelvic ray splinted to the second, i.e., not distinctly separated from it by membrane; incision between third and fourth dorsal spines between one-half and two-thirds.....*P. mexicanus* (p. 77)

3b. Last dorsal ray (always spinous) bound down distinctly more to caudal peduncle than to caudal fin; third pelvic ray not a splint, but free from second distally; incision between third and fourth dorsal spines usually less than one-third.

4a. First dorsal spine more than 10% of standard length; first 2 dorsal spines flexible; tips of last rays of anal and dorsal extending equally onto caudal base; dorsal and anal rays total less than 47.....*P. beebei* (p. 81)





GRAPHS 18-19. Secondary sexual dimorphism in *Paraclinus*. Graph 1 Standard length into upper jaw length, in percents. Graph 19. Standa length into eye-to-preopercle distance, on line of greatest bony postor tal length, in percents.

4b. First dorsal spine less than 10% of standard length; first 2 dor spines inflexible; tips of last rays of anal extending farther o caudal base than tips of last dorsal rays; dorsal and anal rays to more than 50.

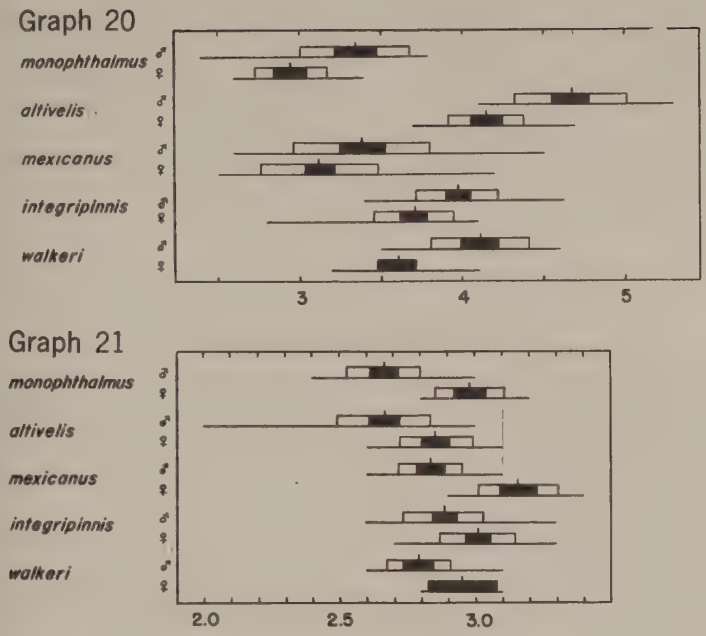
5a. Branchiostegal rays 6 (rarely 5, never 7) in 120 specimens..... .....*P. integripinnis* (p.

5b. Branchiostegal rays 7 (2 with 6 on both sides and 5 with 6 on side) in 110 specimens.....*P. walkeri* (p.

Sexual Dimorphism of PARACLINUS

The Pacific species of this genus frequently show secondary sexual morphism. Throughout the descriptions of the individual species there notes showing the extreme variation.

The most easily recognizable dimorphism is seen by the upper jaw. most specimens posterior end of maxillary reaches to a point below mi of eye in females and to a point below posterior end of eye in males. the 5 species measured, the proportion of upper jaw length to stan length (expressed in percents) is statistically very significantly gre in males than in females (Graph 18); in all species treated except *mon thalmus* there was no overlap in the standard deviations. The table



GRAPHS 20-21. Secondary sexual dimorphism in *Paraclinus*. Graph 20. Standard length into interorbital width, in percents. Graph 21. Standard length into distance between anal base and pelvic base, in percents.

Measurement of sexual dimorphism do not include *P. beebei* because there were too few females in the collections to treat them statistically. In all species but *beebei* the maxillary bone in males is expanded dorsally so that it is about twice as deep as in females (equal to one-half eye depth or more in males, and one-half or less in females).

The preopercle is located a little farther behind eye in males than in females. The distance from eye to posterior margin of preopercle (taken in line of greatest postorbital bony length) is significantly longer in males of *altivelis*, *mexicanus*, and *integripinnis* and slightly significantly longer in males of *monophthalmus*. The measurements in *walkeri* do not show a significant difference; however, the average distance from eye to preopercle in males is greater than that in females, as is true of the other species (Graph 19).

The interorbital is wider in males than in females; in all species measured its proportion to standard length is significantly greater in males (Graph 20).

The distance from anal base to pelvic base is significantly greater in females of *monophthalmus*, *altivelis*, *mexicanus*, and *integripinnis* and slightly significantly greater in female *walkeri* (Graph 21). There is no overlap between the standard deviations of the 2 sexes in the tabulations for *monophthalmus* and *mexicanus*.

In *Paraclinus monophthalmus* and *P. altivelis* the dimorphism is especia ly pronounced in the degree of separation of the first 3 dorsal spines fr the rest of the fin. In immature fishes the first 3 spines are complete separated. As the fishes grow older the membrane grows posteriorly, b coming barely attached to base of fourth spine in large adult females a attached for one-fourth (or more) the length of fourth spine in large adu males.

In general the males are larger. Both of the 60-mm. fish examined we males, and of the 50-mm. fish 32 of the 47 were males.

In *Paraclinus beebei* two added characters are present in males but a sent in females: conical teeth on the anterior ends of the palatine bone and a small patch of scales on the lower edge of the anterior pectoral bas

Paraclinus altivelis (Lockington)
For synonymy see subspecies

Dorsal XXVIII to XXX (XXVIII to XXIX); anal II, 15 to 19 (16 to 18 total dorsal and anal rays 45 to 51 (47 to 49); caudal 11 to 13 (11); pe torals 12 to 14 (13); pelvics I, 2 to I, 3 (I, 3); branchiostegal rays lateral line scales 32 to 37 (33 to 36); scale rows from anal posterior to lateral line 5 to 7 (6 to 7); scale rows from dorsal posteriorly to la eral line 0 to 3 (2 to 3); gill rakers 1 to 2 + 3 to 4.

Head pointed. The projecting lips and lower jaw give the snout an u turned appearance. Lips twice as wide as suborbital in males and 1.5 tim as wide in females. Upper jaw extends to a point below middle of eye females and to below posterior third in males, but never extends behind ey Maxillary is only slightly deeper in males than in females. Interorbit wide and flat-topped, with slightly sloping sides. Cirri moderately lon the largest (those over eye) about one-half eye diameter.

The body profile is straight to slightly convex as it rises gently fr snout to first dorsal spine, then is almost horizontal to fourth spine, b hind which it drops gradually to about twentieth spine, then more abrupt to caudal peduncle, on which it is again horizontal. Peduncle short a deep. Head and trunk slightly compressed.

First dorsal spine originates over posterior margin of preopercle. F spines sharp. First 2 thin and flexible, the third thin and rigid, the r mainder stout and inflexible. First spine the longest, second and thi progressively shorter, fourth about as long as third, fifth and six slightly longer, but shorter than the first 2. The fin outline is th horizontal to the last 3 spines, which are progressively shorter. For entire length last spine bound down by a membrane attached chiefly to ca dal peduncle but in part to caudal base. The spines become progressive more widely spaced toward front of main part of fin; the third spine sep rated from fourth by more than twice distance between fourth and fift second and third by about twice that distance, the first and second by ab that distance. Each spine bears a flag. Membranes very slightly incis except the one between the third and fourth spines, which varies from or seventh incised in some adult males to completely incised in young fema and immature males.

First anal spine goes 1.3 and 2.0 times into second spine and first s ray respectively; the rays become gradually longer as far as last 2, wh are progressively shorter. Tips of last anal rays extend farther bey caudal base than do those of dorsal spines; last ray attached by a membr to caudal peduncle for one-half its length. Membranes incised one-thi

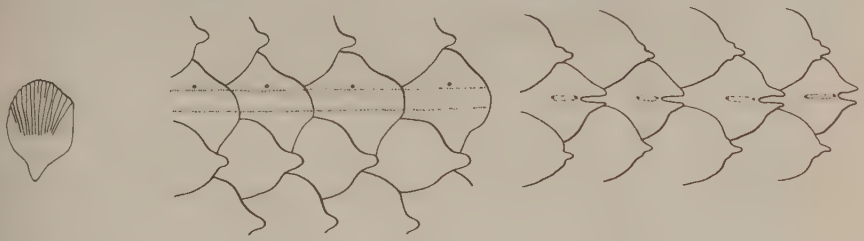
Pectorals long and bluntly pointed. Upper rays thinner than lower on Pelvics long and pointed; second soft ray slightly longer than first; th very short but separated from second by a small membrane distally.

very narrow membrane between first and second rays incised one-half.

Each scale except those forming the lateral line row bears one to 5 fleshy posterior projections (Fig. 10).

Lateral line extends posteriorly in a gentle arc for about 12 scales, then drops rapidly to midline, and from there runs straight to caudal base. The anterior segment has no external pores, for each opening lies under the next anterior scale. Most anterior scales, however, have a clear spot which appears to be a vestige of an external pore (Fig. 11). The posterior scales have a pore at each end of a tube (Fig. 12). Lateral line canals on head complete, each canal has at least a double row of pores (one on each side of canal).

igure 10 Figure 11 Figure 12



FIGS. 10-12. *Paraclinus altivelis*. Fig. 10. Body scale. Fig. 11. Anterior lateral line scales. Fig. 12. Posterior lateral line scales.

The life colors as exhibited by many fresnly preserved formalin specimens from near Guaymas are bright but variable. Ground color varies from bright to chalky pink, the pattern from almost uniform to strongly barred and variegated. Five crossbars usually evident on body, especially toward head; these bars do not ring the belly, which is not lighter than interspaces on the sides. The extensions of the body bars onto dorsal fin are reddish. There is a black bar between each of these dorsal red bars, except the first 2. In the last black bar, a black ocellus with a light ring extends from the twenty-second to the twenty-fourth spine. A vertical black bar on caudal fin, located from one-sixth to one-third of the way out on the fin, is connected with caudal peduncle marking by a lighter brown line medially; distal to this vertical bar the rays have reddish spots arranged to form irregular, vertical bars. Anal colored like dorsal, except that all bars are black, and interspaces dark. Tips of rays light-edged. Pectorals have a dark, vertical bar from eighth to twelfth ray about one-third of the way out; proximally this fin is light; distally it is barred like distal part of caudal. Pelvics have a dark base and about 6 distinct spots on each ray. Head light colored with as many as 4 darker-lined dark spokes around eye: one posterodorsal, one dorsal, one anteroventral, one ventral. Posterior margin of preopercle may be dotted with black or blotched with light. Either color scheme may be extended over mandible. Upper lip darkened distally and in middle, where it is crossed by 2 spokes from eye. Cirri dark, light, or both. A longitudinal, reddish stripe often runs from cheek backward across pectoral base and is frequently interrupted on body.

The species is here divided into 2 subspecies. The first, *Paraclinus altivelis sini*, has been taken only in Scammon Lagoon and San Ignacio Lagoon on the outer side of Baja California. It apparently lives in sponges on a sandy bottom. The other subspecies, *Paraclinus altivelis altivelis*, is re-

stricted to the Gulf of California. Its abundance at the four areas collected—La Paz and Santa Inez Bay on the peninsula of Baja California and Rocky Point Bay (Puerto Peñasco) and Guaymas on the mainland—suggests that it is distributed over most of the Gulf. It has been collected chiefly in rocky areas where sponges abound. Although the type is recorded from 22 fathoms, all other specimens were taken from less than 2 fathoms.

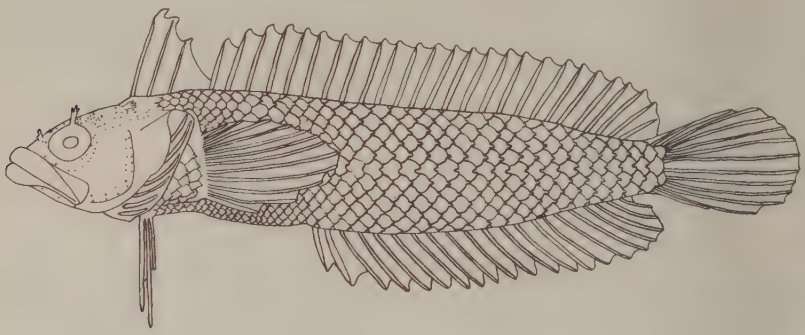


FIG. 13. *Paraclinus altivelis altivelis*. A 39-mm. male from TNHC 413.

Paraclinus altivelis altivelis (Lockington)
Figure 13

Cremnobates altivelis Lockington, 1881, p. 114, 116 (type locality La Paz, Baja California, at 22 fathoms (?); holotype in Academy of Nat. Sci. Philadelphia).—Jordan, 1885b, p. 390; 1885a, p. 909.
Cremobates monophthalmus (nec Günther) Vaillant, 1894, p. 73.
Auchenopterus altivelis Jordan and Evermann, 1896a, p. 469.
Auchenopterus (Corallicola) altivelis Jordan and Evermann, 1898, p. 2370.
Corallicola altivelis Jordan, Evermann and Clark, 1930, p. 456.—Fowler, 1944, p. 520.
Paraclinus altivelis Storey, 1940, p. 86.

This subspecies may be separated from *P. a. sini* in the account for the latter subspecies.

The following 212 specimens, from 22 to 50 mm., were examined: 4 from Espiritu Santo Island, Gulf of California, CAS 20464 and SU 16198; 9 from Santa Inez Bay area, Gulf of California, USNM 152010, SU 16196 and 16197, and NYZS 25237; 14 from Rocky Point (Punta Peñasco) Sonora, Mexico, TNHC 413 and SU 16199, 16200, 16201, and 16205; and 187 from the vicinity of Guaymas, Sonora, Mexico, CAS 20465, 20466, and 20467 and SU 16484.

Paraclinus altivelis sini Clark Hubbs, new subspecies
Figure 14

The snout of this new subspecies is shorter than that of *P. a. altivelis*; if snout length is divided by standard length there is no overlap between the standard deviations of the proportions for the fishes of the two subspecies (Graph 22). The head of *P. a. sini* is much shorter, on the average, than that of *P. a. altivelis*; when the proportion of head length to standard length is compared in the 2 subspecies, there is no overlap in the standard deviations (Graph 23). *P. a. sini* has a significantly smaller

number of dorsal and anal fin rays than does *P. a. altivelis* (Graph 24). The color of *P. a. sini* tends to be darker than that of the typical subspecies.

Named *sini* from the Latin noun *sinus*, a bay or gulf, because it typically inhabits large bays.

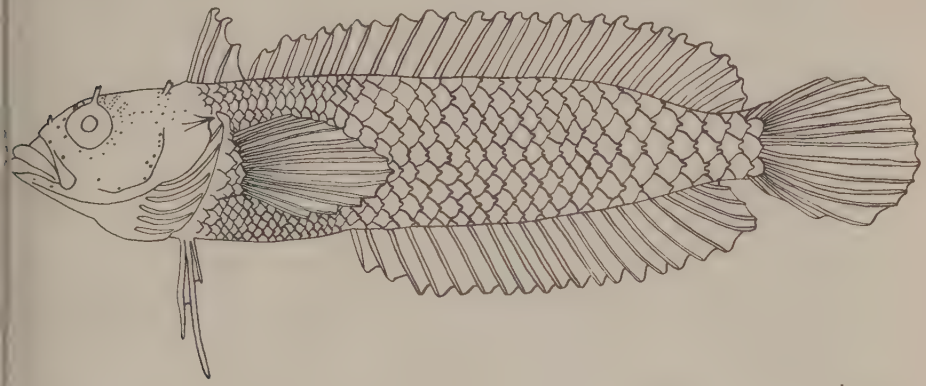
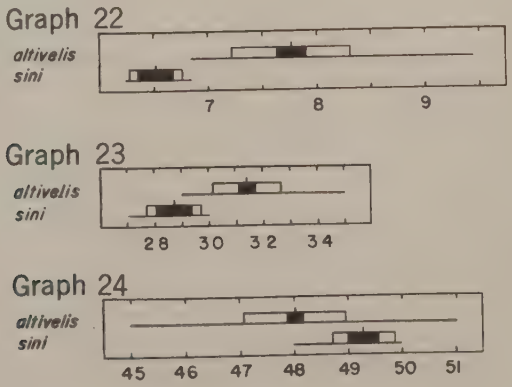


FIG. 14. *Paraclinus altivelis sini*, n. subsp. A 21-mm. young specimen from TNHC 430.

The 33.5-mm. holotype (SU 16206) was dredged from 3.25 to 3.75 meters in San Ignacio Lagoon, Baja California, on February 11, 1950, by Carl L. Hubbs and party. The following 14 specimens, from 16.5 to 38.5 mm., from the type locality are designated as paratypes: SU 16207, CAS 20468, TNHC 430, and USNM 151996. Two 24-mm. specimens (SU 16208) from Isla Concha, Scammon Lagoon, Baja California, were not designated as paratypes because of their poor condition.



GRAPHS 22-24. Subspecies of *Paraclinus altivelis*. Graph 22. Standard length into snout length, in percents. Graph 23. Standard length into head length, in percents. Graph 24. Sum of dorsal and anal fin rays.

Paraclinus monophthalmus (Günther)

Auchenopterus monophthalmus Günther, 1861a, p. 275 (type locality Pac coast of Panama; holotype in British Museum).—Jordan and Everm 1896a, p. 469 (in part).—Gilbert and Starks, 1904, p. 189.—Ker and Radcliffe, 1912, p. 152.—Meek and Hildebrand, 1928, p. (in part), pl. 93, fig. 2.—Jordan, Evermann and Clark, 1930, p. (in part).—Whitley, 1937, p. 143.—Tortonese, 1939, p. 55.

Cremnobates monophthalmus Günther, 1861b, p. 374; 1868, p. 389, 442, 69, fig. 1.—Jordan and Gilbert, 1882c, p. 111; 1883a, p. 628.— dan, 1884, p. 142; 1885b, p. 390.

Auchenopterus (Auchenopterus) monophthalmus Jordan and Evermann, 1898 2372 (in part).

Paraclinus monophthalmus Storey, 1940, p. 85.—Fowler, 1944, p. 284, (in part), fig. 247.

Dorsal XXVIII to XXX (XXVIII to XXIX), ½; anal II, 18 to 20 (19); t dorsal and anal rays 49 to 53 (50 to 51); caudal 10 to 11 (11); pectc 11 to 14 (13); pelvics I, 3, branchiostegal rays 5 to 6 (6); lateral scales 36 to 40 (37 to 39); scale rows from front of anal posteriorl lateral line 5 to 7 (6 to 7); scale rows from front of dorsal posteri to lateral line 3 to 4 (3); gill rakers 1 + 6.

Head and snout sharply pointed. Lower jaw slightly projecting. Ir mature specimens and females the slightly projecting lips equal the su bital, but are 1.5 times wider in mature males. In immatures and fem upper jaw extends to a point below middle of eye, but reaches just beh point below its posterior border in mature males. Maxillary expanded sally in males, equaling two-thirds of eye diameter, in females it is half eye diameter. The broad interorbital is flat. Cirri all less one-half eye diameter.

The dorsal profile is convex as it rises gently from snout to n where a second convex elevation extends to fifth dorsal spine; then profile declines smoothly and gently to fourth-from-last spine, wher dips more sharply to caudal peduncle, on which it is horizontal. Pedu short and deep. Body slightly compressed, head rounded.

First dorsal spine originates over posterior margin of preopercle. sal spines all sharp; the first two thin and flexible; third thin rigid; the others stout and inflexible. First dorsal spine the long next 2 spines progressively much shorter. Fourth spine is about length as third; fifth and sixth progressively longer. The fin out then levels off as far as the last 2 spines, which are slightly shor The soft ray is even shorter but still projects slightly from outlin descending fin. Tips of last rays, especially soft ray, project be base of caudal, the last ray broadly joined by a membrane attached ch to caudal peduncle but also, in part, to caudal base. All spines be first 4 approximately evenly spaced, the last ones slightly closer tog than the first ones. The space between third and fourth more than 2 " distance between fourth and fifth. First 3 spines placed slightly c. together than posterior ones. Membranes not incised except that bet third and fourth spines. In some cases, usually females and immature cimens, this membrane is completely incised, dividing the parts into rate fins; in others, usually mature males, the membranes are attach the proximal fourth of the fourth spine. The spines do not bear flags

The first anal spine contained 1.3 and 2.0 times in second spine first soft ray respectively. Length of rays increases gradually as f last 2, which are shorter. Last ray attached by a membrane to cauda duncle for one-half its length. Membranes incised one-half.

The eighth ray of the long and bluntly pointed pectorals is the longest. e rays are equally stout. The second ray of the long and pointed pelvics the longest. The third is degenerate but separated from the second by membrane distally. The small membranes are incised about two-thirds. No fleshy posterior projections on the scales. They bear radii only on eir anterior margins (Fig. 15).

The scales in anterior section of lateral line have no external pores r vestiges of any) as each pore opens under preceding scale (Fig. 16). sterior scales have a pore at each end of a tube (Fig. 17).

The color pattern is described entirely from preserved specimens. Body ain light brown or light brown with 4 dark brown, vertical blotches dor- lly and laterally. Belly white. First dorsal brownish. Second dorsal milarly colored but lighter, with 6 faint, vertical, light bars. A dark ellus with a light margin extends from the twenty-third to twenty-fiftn ines. Caudal very light brown with a more-or-less pronounced dark, ver- cal bar connected to the body color by a central band. Anal brownish tn 6 rust-brown bars more or less noticeable; tips of rays colorless. ctorals brownish, lighter distally. They may or may not have dark dots ich form irregular crossbars on the rays. Pelvics similarly colored; if ossbars are present, there are 4. Head colored like body, with a dark rk on upper margin of opercle and 3 dark spokes leading from eye: one sterodorsal, one ventral, and the third anteroventral.

Figure 15

Figure 16

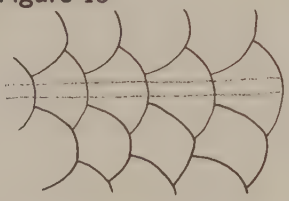
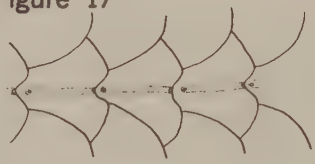


Figure 17



FIGS. 15-17. *Paraclinus monophthalmus*. Fig. 15. Body scale. Fig. 16. nterior lateral line scales. Fig. 17. Posterior lateral line scales.

This species does not range as far to the north as the literature indi- ates, since a large number of the records for this species are based on pecimens of *P. mexicanus*. The specimens of *P. monophthalmus* here examined re all from the Gulf of Panama (several localities) except for a single pecimen from Port Parker, Costa Rica, believed to be a stray. Reliable ecords, however, extend the range of this species southward into Ecuador. ll known specimens are from tidepools.

The following 72 specimens, from 28 to 65 mm., were examined: 31 from anama, SU 6928 and USNM 50456; 36 from Panama, Panama, USNM 81902, 81903, 81904, and 81905; 4 from Balboa, Canal Zone, USNM 81906 and 81907; and one rom Port Parker, Costa Rica, NYZS 28029.

Paraclinus mexicanus Gilbert
For synonymy see subspecies

Dorsal XXVII to XXXI (XXVIII to XXIX), 0 to 1 (½); anal II, 16 to 19 (17 to 18); total dorsal and anal rays 46 to 53 (47 to 50); caudal 11 or

13; pectorals 12 to 14 (13); pelvics I, 3; branchiostegal rays 5 to 6 (6
lateral line scales 31 to 36; scales from anal posteriorly to lateral li
5 to 7 (6 to 7); scales from dorsal posteriorly to lateral line 0 to 4
to 3); gill rakers 1 + 5 to 7.

Snout rather bluntly pointed. Lower jaw projects very slightly. T
slightly projecting lips vary in thickness from 1.3 times suborbital in f
males and immature specimens to twice that distance in mature males. Upp
jaw likewise varies in length, extending to a point below middle of eye
immature specimens, almost to a point below posterior end of eye in matu
females, and beyond eye in mature males. Depth of maxillary bone similar
varies from one-third eye diameter in immature specimens to one-half in m
ture females and two-thirds in mature males. Interorbital broad and fla
Posterior margin of preopercle three-fifths of the way back on postorbit
bony head length. Cirri numerous but short, never more than one-half e
diameter.

The body profile is convex as it rises gently from snout to nape, with
slightly sharper rise in front of eye; then a convex rise to about the se
enth spine. Profile then drops evenly to about twenty-second spine, whe
it drops more steeply to caudal peduncle which is horizontal. Pedunc
very short and deep. Body and head slightly compressed.

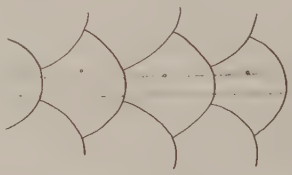


FIG. 18. *Paraclinus mexicanus*. Anterior lateral line scales.

First dorsal spine originates at a point just in front of middle of
ercle. All dorsal spines sharp. The first 2 thin and flexible, third t
and rigid, the remainder stout and inflexible. First dorsal spine shor
than average length of dorsal spines; second and third progressively sho
er; fourth the same size as third; fifth and sixth respectively longe
The fin rays remain high to last 3 spines, which are shorter. Although
soft ray is even shorter, it still projects somewhat and is bound down
a membrane attached equally to caudal peduncle and caudal fin. The ra
become progressively farther apart anteriorly as far as fourth spi
Third ray half again as far from fourth spine as latter is from fifth spi
second and third spines are slightly closer together, and distance betw
first 2 spines is half that distance. Membrane very slightly incised
cept between third and fourth spines where it is incised two-thirds; m
brane attached to fourth spine, never separated as in adult *monophthalmu*

First anal spine contained 1.3 and 1.8 times in second spine and fi
soft ray respectively. Soft rays become progressively longer as far
last 2, which are noticeably shorter. Last ray not attached to caudal
duncle by a membrane. Membranes incised one-third.

The eighth ray of the long and bluntly pointed pectorals the longe
lower rays stouter than upper rays. Second ray of the long and poin
pelvics the longest; the third is a splint, not separated from second b
membrane. Membrane between first 2 rays very limited in breadth and
cised one-half.

The scales do not have posterior fleshy projections and have radii only on the anterior margins, as in *P. monophthalmus* (Fig. 15).

Anterior segment of lateral line bears no external pores since each opening lies under the next anterior scale. Just above the canal on most of the anterior lateral line scales there is a series of clear spots which appear to be vestigial pores (Fig. 18). The posterior segment consists of a pore at each end of a tube, as in *P. monophthalmus* (Fig. 17).

The life colors as exhibited by fresh and alcohol-preserved specimens show extreme variability. Dark ground-color of body brownish to purplish. About 6 very irregular crossbars grade from black near head to brown on caudal peduncle. Belly lighter, but not colorless. Lower half of lighter dorsal fin has continuations of the body crossbars, especially noticeable on first dorsal spines. A black ocellus with a white margin lies in a black blotch on twenty-second to twenty-fourth spines. There may be a trace of another at posterior end of fin. Caudal has a light base with a dark streak which runs back across center connecting the dark body color with a dark bar on anterior portion of caudal; dark spots on rays form irregular vertical bars. Anal dark with light margin. Pectorals have a dark spot at base of fin and dots on rays forming irregular vertical bars; a black spot immediately above pectoral base. Pelvics clear, dark, or dark with obscure spots on rays. In general, head colored like body; a row of dark spots along posterior margin of preopercle continues onto mandible; 3 more-or-less-pronounced dark spokes from eye: one posterodorsal, one anteroventral, and one ventral.

This species ranges from the Gulf of Panama to Guaymas, Sonora, and La Paz, Baja California. Only one record of *P. mexicanus* (from Perico Island) has been recorded from south of Bahia Honda, Panama, where *P. monophthalmus* is dominant. At the northern end of the range, on the mainland, no records are available between Mazatlan, where *mexicanus* is very common, and Guaymas, where it is much rarer than *altivelis*. In Baja California the species is commonly taken at La Paz, in the Gulf, where it seems to outnumber *P. altivelis*, but no records are available for the Pacific Ocean side of the peninsula. The specimens from Cleopha Island in Las Tres Marias Islands show several differences from the mainland specimens and are described below as *Paraclinus mexicanus cleophensis*. The fishes of both subspecies are apparently tide-pool inhabitants: all of the *cleophensis* specimens were taken from tide pools, as were the large majority of the mainland specimens.

Paraclinus mexicanus mexicanus Gilbert
Figure 19

Cremnobates integripinnis (nec Rosa Smith) Jordan and Gilbert, 1881b, p. 63 (in part); 1882a, p. 108; 1883b, p. 764 (in part).—Jordan, 1885a, p. 910 (in part); 1885b, p. 390 (in part).

Auchenopterus monophthalmus (nec Günther) Jordan, 1895, p. 501.—Jordan and Evermann, 1896a, p. 469 (in part).—Meek and Hildebrand, 1928, p. 932 (in part).—Jordan, Evermann and Clark, 1930, p. 457.—Tortonese, 1939, p. 55 (in part).—Seale, 1940, p. 38.

Auchenopterus (Auchenopterus) monophthalmus (nec Günther) Jordan and Evermann, 1898, p. 2372 (in part).

Auchenopterus mexicanus Gilbert, 1904, p. 269, pl. 29 (type locality La Paz, Baja California; nolotype SU 6486).—Jordan, Evermann and Clark, 1930, p. 457.

Paraclinus mexicanus Storey, 1940, p. 86.—Fowler, 1944, p. 521.

Paraclinus monophthalmus (nec Günther) Fowler, 1944, p. 521 (in part).

The fishes of this subspecies do not vary appreciably despite their wi range along the coast of Central America and Mexico, and the types from Paz, Baja California, agree very closely with the other specimens.

This subspecies is distinguished from *P. mexicanus cleophensis* unc that heading.

The 46-mm. holotype (SU 6486) and 11 paratypes, from 32 to 46 mm., (238) collected by C. H. Gilbert from La Paz, Baja California, were exa

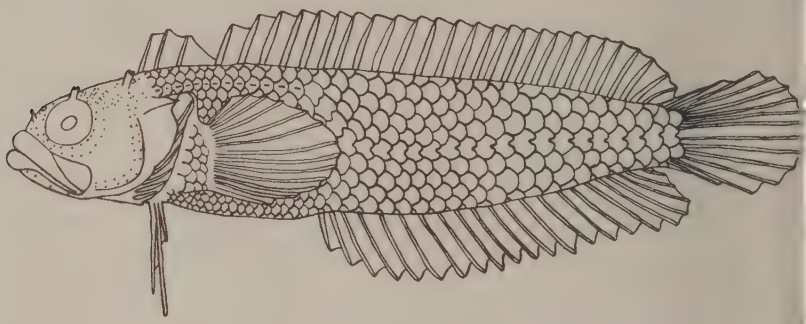


FIG. 19. *Paraclinus mexicanus mexicanus*. A 38-mm. male from TNHC 4

ined. The following 197 other specimens, from 22 to 46 mm., were also amined: 2 from Perico Island, Gulf of Panama, USNM 65429; 28 from Ba Honda, Panama, CNHM 51442, USNM 152007, and SU 16218, 16219, 16220, 162 and 16222; 49 from Piedra Blanca Bay, Costa Rica, NYZS 28168, SU 162 CNHM 51444, USNM 152009, and RUC; 17 from Port Culebra, Costa Rica, 20470 and SU 16216; 58 from Port Parker, Costa Rica, CNHM 51437, SU 162 16212, 16213, and 16214, CAS 20469, TNHC 410, and NYZS 27938; one from P Guatulco, Mexico, SU 16210; 10 from Acapulco, Mexico, SU 16224 and T 411; 4 from Chamela, Mexico, SU 16209; one from Mazatlan, Mexico, SU 29 22 from La Paz, Baja California, SU 2981 and USNM 126709; and 6 from Gu mas, Sonora, Mexico, SU 16539.

Paraclinus mexicanus cleophensis Clark Hubbs, new subspecies
Figure 20

This insular form has statistically fewer lateral line scales (Gr 25), dorsal spines (Graph 26), and anal soft rays (Graph 27) than doe *m. mexicanus*. These characters have considerable overlap, but if the ber of dorsal and anal rays are added to the number of lateral line sca their standard deviations scarcely overlap (Graph 28). In addition, head is statistically longer in *P. m. cleophensis* than in the mainland (Graph 29). These facts, together with the homogeneity of the main population, seem to justify proposing this subspecies.

The subspecies may be present on all Las Tres Marias Islands. Howe investigation of the other islands is advisable. They are more dista removed from the mainland and may have more extreme forms; if so, *P cleophensis* would be intermediate. The other islands may have dist fishes which have evolved separately from the Cleopha specimens and w represent much-differentiated species or subspecies. They might conc ably have typical *mexicanus*, in which case the Cleopha Island speci

ould be farther separated taxonomically, but not geographically, from the ainland subspecies than would the fishes from the outer islands.

Named *cleophensis* from its geographic locality.

The 37-mm. holotype (SU 16225) was collected on February 23, 1940, by ernon Brock from a tide pool on Cleopha Island, Las Tres Marias Islands, lexico. The following 40 specimens, from 20 to 38 mm., with the same data re designated as paratypes: SU 16226, TNHC 409, and USNM 151993.

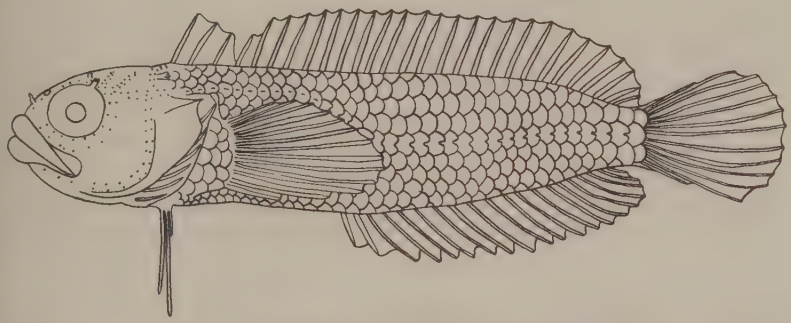
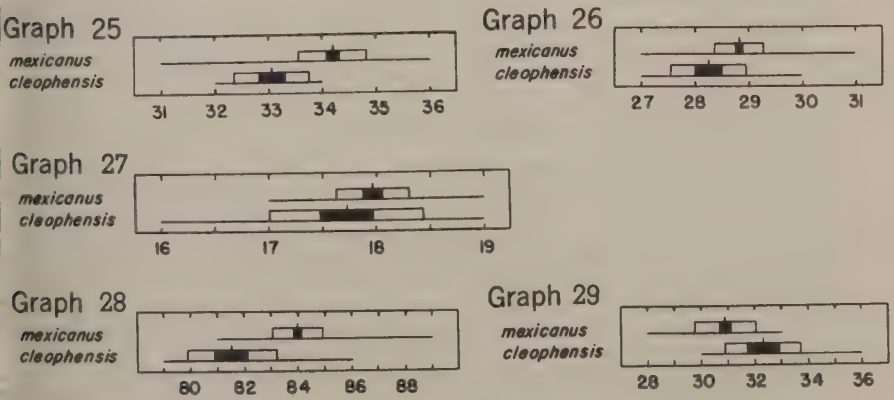


FIG. 20. *Paraclinus mexicanus cleophensis*, n. subsp. A 20-mm. young specimen from TNHC 409.

Paraclinus beebei Clark Hubbs, new species
Figure 21

Dorsal XXVII to XXVIII (XXVIII); anal II, 15 to 17 (16); total dorsal and anal rays 44 to 47 (46); caudal 11; pectorals 12 to 14 (13); pelvics I, 3; branchiostegal rays 6 to 7 (6); lateral line scales 32 to 35 (32 to 34);



GRAPHS 25-29. Subspecies of *Paraclinus mexicanus*. Graph 25. Lateral line scales. Graph 26. Dorsal spines. Graph 27. Anal soft rays. Graph 28. Sum of lateral line scales and dorsal and anal fin rays. Graph 29. Standard length into head length, in percents.

scale rows from anal posteriorly to lateral line 4 to 5 (5); scale rows from dorsal posteriorly to lateral line 0 to 2 (0 to 1); gill rakers 1 + 4.

Head pointed. In well-preserved specimens the projecting lips give snout an upturned appearance. Jaws equal. Lips about 1.5 times as wide a suborbital. In females maxillary reaches to a point below middle of eye, in males to a point below posterior border of eye, but it is not expanded dorsally in males as it is in males of other members of the genus. Interorbital space flat. Cirri on head vary from one-fifth to one-half eye diameter.

Conical teeth always present on premaxillaries, mandibles, and vomer and also on anterior portion of palatines in males. Teeth on jaws compose of an outer row of larger teeth and an inner band of smaller ones, with a few scattered, larger teeth beyond end of inner band. Vomer and palatine have a single, irregular row of larger teeth.

The body profile in mature females rises evenly from snout to nape, in males it rises in a gently convex manner, and in young the rise is convex with a slight break above eye. From nape, in all cases, profile extends gently upward in a convex manner to seventh spine, from which point it drops gently for about 13 spines, then more steeply to caudal peduncle.

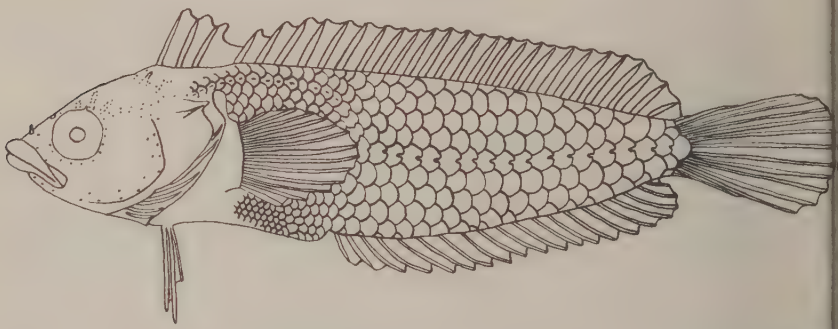


FIG. 21. *Paraclinus beebei*, n. sp. A 19.5-mm. young female from TNHC 408.

which is horizontal. Peduncle short and deep. Both body and head compressed.

First dorsal spine in females begins over posterior edge of preopercle and in males two-fifths distance back on opercle. Dorsal spines all sharp, the first 2 thin and flexible, the third thin and inflexible, the rest stout and rigid. First dorsal spine the longest, the second slightly shorter, the third much shorter, the fourth spine about as long as third. The spines increase in length up to fourth-from-last spine (increase greatest at fifth and sixth spines); the last 4 spines are progressively shorter. Last spine bound down for its entire length by a membrane chiefly attached to caudal peduncle but in part to extreme base of caudal fin. Spines slightly farther apart anteriorly as far forward as fourth spine. Third and fourth spines 1.5 times as far apart as fourth and fifth; second and third the same distance apart as fourth and fifth, first and second half that distance apart. The spines all bear flags. Membranes between spines slightly incised except for that between third and fourth, which is incised one-third in both sexes.

First anal spine goes 1.2 and 2.0 times into second spine and first soft

respectively. Rays become gradually longer up to next-to-last, after ch they are slightly shorter. Last ray attached for one-half its length a membrane to caudal peduncle. Membranes incised one-third to one-half. The ninth ray of the bluntly pointed pectorals is the longest. The er rays are thicker than the upper. Second ray of the pointed pelvics longest, the third short but separated, at least distally, by a mem- ne. The narrow membrane between first and second rays incised one-third. The large and imbricate scales are present on extreme base of caudal , but on no other fin; absent on head, pectoral base (except extreme erior ventral corner in males), and nape as far posterior as third dor- spine. The scales bear no fleshy, posterior projections. Radii are sent on the anterior margins of the scales, as in *P. monophthalmus* (Fig.

The scales in anterior arc of lateral line canal bear no external pores ice each opens under the next anterior scale (Fig. 16). No vestiges of ernal pores. The posterior section consists of a pore at each end of a e (Fig. 17).

The colors as seen in both fresh and alcohol-preserved specimens are e constant in this species than in other members of the genus. Ground or rosy black. With the exception of one specimen with 6 dark crossbars ne of the fish have body markings. Dorsal and anal pinkish; except for e barred specimen the only mark on these fins is an ocellus, with no ght ring, on the twenty-first spine. In the barred specimen crossbars ntinue faintly onto dorsal, and there are 6 dark, vertical bars on anal. udal clear except for faint spots forming light, vertical bars; in the rred specimen there is a dark bar from one-sixth to one-third of the way t, connected centrally to dark color of caudal peduncle. Pectorals col- ed like distal section of caudal. Pelvics have a few dark spots on the ys. A brilliant silver bar behind eye continues onto pectoral fin base. is is the most prominent field color. Head otherwise plain, except that rred specimen has a dark line below the silver bar.

The recorded range of this species is from Arroyo Seco, Baja California, Bahia Honda, Panama. It has been taken at only two other localities: apulco, Mexico, and Piedra Blanca Bay, Costa Rica. It is very rare in llections, doubtless because the fishes inhabit the infratidal zone, an ea neglected by most collectors. It is a typical *Paraclinus* in that it taken from rocky coasts, possibly out of sponges.

Named *beebei* for William Beebe, who collected the holotype.

The 23-mm. holotype (NYZS 28152) was collected by William Beebe on Feb- ary 2, 1938, from Piedra Blanca Bay, Costa Rica. The following 28 speci- ns, from 19 to 29 mm., are designated as paratypes: 2 from Bahia Honda, nama, SU 16227 and NYZS 28590; 20 from Piedra Blanca Bay, Costa Rica, SU 228, CAS 20471, and USNM 151992; 2 from Acapulco, Mexico, TNHC 408; and from Arroyo Seco, Baja California, SU 16229.

Paraclinus integripinnis (Rosa Smith)
For synonymy see subspecies

Vertebrae 12 + 25 to 27 (26) = 37 to 39 (38) for *P. i. integripinnis* ly; dorsal XXX to XXXIII (YXXI to XXXII); anal II, 18 to 20 (19); total rsal and anal rays 51 to 55 (52 to 54); caudal 10 to 11 (11); pectorals to 14 (13); pelvics 0, 0 to I, 3 (I, 3); branchiostegal rays 5 to 6 (6); cales in lateral line 34 to 39 (36 to 37); scale rows from front of anal steriorly to lateral line 5 to 6; scale rows from front of dorsal poster- rly to lateral line 2 to 4 (3); gill rakers 2 + 4.

Head bluntly pointed. Jaws equal. The projecting lips 1.3 times sub- bital in females and 1.5 in males. Upper jaw extends to a point below

middle of eye in females, below rear of eye in males. Maxillary expanded dorsally in males, being twice suborbital distance, in females equal to that distance. Broad interorbital flat to very gently concave in center. Posterior edge of preopercle in middle of postorbital bony head length. Cirri all flattened, short (the longest about one-half eye diameter), and not divided to the base.

The profile is convex as it rises gently from snout to fifth dorsal spine, then gently decreases to twenty-fourth, then more steeply to last spine, from which it runs horizontally to the caudal fin.

First dorsal spine originates over anterior one-third of opercle. All dorsal spines sharp and rigid; first 3 thinner than remainder. The first spine short (not above average length for dorsal spines), the second and third progressively shorter, the fourth equal to third in length. The remaining rays become gradually longer (more rapidly at first) up to last 3, which become progressively shorter. For its entire length last spine bound down by a membrane attached chiefly to caudal peduncle but in part to base of caudal fin. Spines become progressively more widely spaced toward front of fin to fourth spine. Both the next 2 preceding interspinous distances are 1.5 times distance between fourth and fifth spines; first 2 spines separated by one-half distance between second and third spines. The spines all bear flags. Membranes slightly incised except those between third and eighth spines. Membrane between third and fourth spines incised one-half, the following ones gradually less incised.

First anal spine goes 1.3 and 1.8 times into second spine and first soft ray respectively. Length of rays increases gradually from first to last 2, which are progressively shorter. Tips of last anal rays extend farther beyond caudal base than dorsal spines. The last ray attached for almost half its length by membrane to peduncle. Membranes between rays incised one-third.

The eighth or ninth ray of the bluntly pointed pectorals longest. Lower rays thicker than upper. Second ray of the short and sharp pelvics longest, third reduced but separated from second by a membrane distally. Membrane between first 2 rays incised one-third.

The scales do not have fleshy projections from their posterior margins. They have radii only on their anterior margins, as in *P. monophthalmus* (Fig. 15).

The scales on anterior arc of lateral line have no external pores, for each opening lies under next anterior scale; but most anterior scales have a light spot which appears to be a vestige of an external pore, as in *P. mexicanus* (Fig. 18). The other lateral line scales have a pore at each end of a tube, as in *P. monophthalmus* (Fig. 17).

The life colors on this fish are extremely variable. The basic colors (black, cream, and reddish) may be present in almost any combination on any of the various body parts. In freshly preserved specimens, however, a few basic markings appear. Body dark and blotched with light. Posterior edge of posterior lateral line scales black edged. Belly generally slightly lighter than sides. Dorsal fin dark with a light edging. A jet black ocellus with a light margin is located on membrane between twenty-third and twenty-seventh spines. If the dorsal fin is not jet black, ocellus is located in dark blotch. Basal one-third of caudal is darker than body; distal two-thirds light, with dark spots forming irregular, vertical bars on the rays. Anal dark with light margin. Pectorals have a more-or-less interrupted vertical bar one-third of the way out on the fin; distally the fins resemble distal section of caudal; proximally they are the color of body. A dark spot on pectoral base just above upper ray. Pelvics have dark basal section and spots on distal parts of the rays. Head colored like body, with five spokes more or less noticeable around eye: one posterodorsal, one dorsal, one anteroventral, one ventral, and one posterior

he postlarvae plain, with indications of the adult color pattern only in arger specimens.

The range of this species is from Abreojos Point, Baja California, to ortuguese Bend, Los Angeles County, California, on the mainland; also ound on Guadalupe Island and Los Coronados off the Baja California coast nd on San Clemente Island, California. The southern mainland specimens nd those from Guadalupe Island differ subspecifically *(P. i. zacae)* from hose taken around the type locality, San Diego. The specimens from San elmo Point seem to be intergrades between the two subspecies. The only pecimen (SU 16234, 40 mm.) from inside a bay with a very restricted connection to the open ocean (Mission Bay) likewise appears to be a separate ubspecies. It is not described as such here since further specimens are eeded to check its validity. It differs from typical *P. i. integripinnis* n having 5 branchiostegal rays on each side, while typical *P. i. integripinnis* has 6 rays (4 specimens have 5 on one side and 6 on the other). The bay form also has a longer snout than does typical *integripinnis* (9.0 % of the standard length as compared with 5.8 % to 8.7 %).

The habitat in all but 2 recorded cases is rocky tidal areas; these exceptions are sandy bottom at the mouth of Newport Bay near rocks, and a stony shoal in Mission Bay from which the possible new subspecies was taken. None of the fishes were observed to inhabit sponges, but the possibility is not eliminated as sponges are not rare in the tidal areas of southern California.

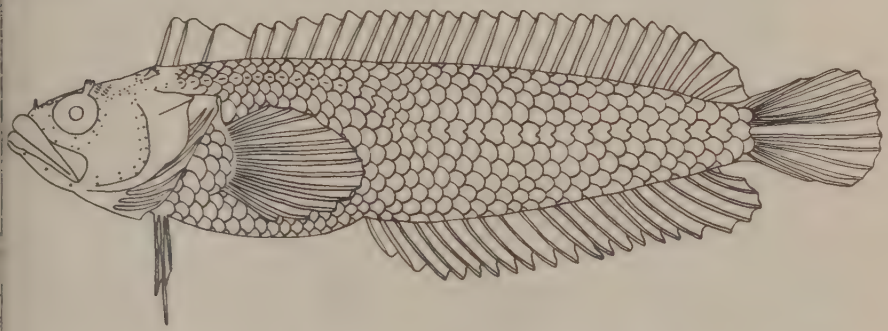
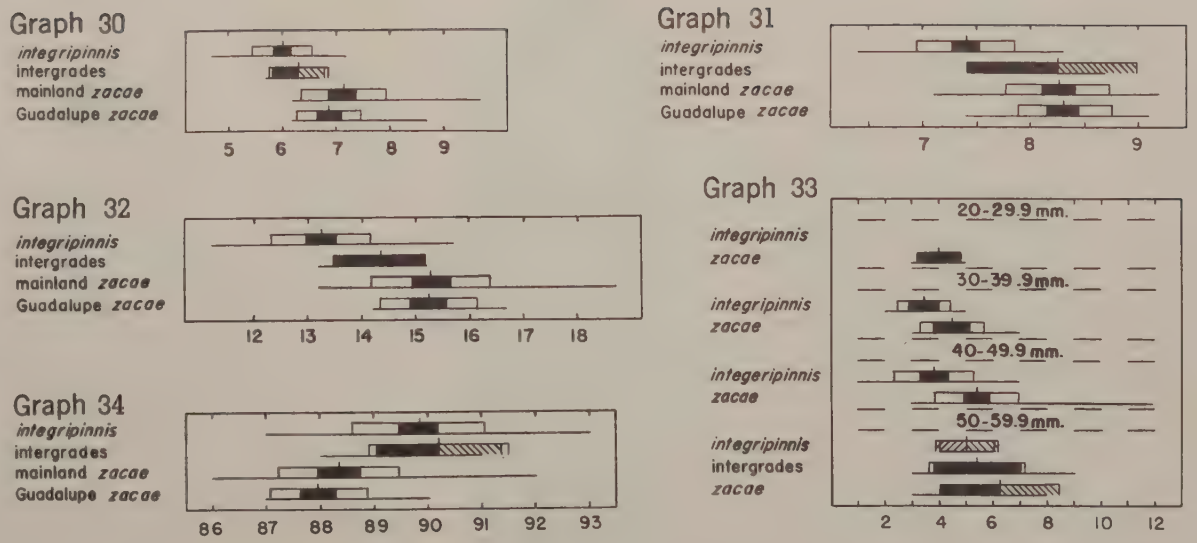


FIG. 22. *Paraclinus integripinnis integripinnis.* A 44-mm. male from TNHC 429.

Paraclinus integripinnis integripinnis (Rosa Smith)
Figure 22

Cremnobates integripinnis Rosa Smith, 1880b, p. 147 (type locality La Jolla, California; holotype "presented to U.S,N.M."); 1880a.—Jordan and Gilbert, 1881a, p. 454.—Jordan and Jouy, 1881, p. 4.—Jordan and Gilbert, 1881b, p. 63 (in part); 1883b, p. 764 (in part).—Rosa Smith, 1883a, p. 216.—Jordan, 1884, p. 142; 1885a, p. 910 (in part). —Rosa Smith, 1885a, p. 45.—C. H. Eigenmann, 1890, p. 35.

Auchenopterus integripinnis C. H. Eigenmann, 1892, p. 131, 171, 173.—Eigenmann and Eigenmann, 1892, p. 357.—Jordan and Evermann, 1896a, p. 469.—Starks and Morris, 1907, p. 237 (in part).—Metz, 1912, p. 53, pl. 3, fig. k, text figs. 22-23.—Fowler, 1924, p. 300.—C. L. Hubbs, 1927, p. 352.—Jordan, Evermann and Clark, 1930, p. 457.—Barnhart, 1936, p. 85, fig. 256.



GRAPHS 30-34. Subspecies of *Paraclinus integripinnis*. Graph 30. Standard length into first dorsal spine length, in percents. Graph 31. Standard length into tenth dorsal spine length, in percents. Graph 32. Standard length into sum of first and tenth dorsal spine lengths, in percents. Graph 33. Orbital cirri, by 10-mm. size groups. Graph 34. Sum of lateral line scales and dorsal and anal fin rays.

enopterus (Auchenopterus) integripinnis Jordan and Evermann, 1898, p. 2372.
clinus integripinnis Storey, 1940, p. 86.—Fowler, 1944, p. 521.

his subspecies is separated from *Paraclinus integripinnis zacae* under account for that subspecies.
he following 85 specimens, from 26 to 54 mm., were examined: one from o Point, Baja California, TNHC 429; one from Descanso Point, Baja Cal-nia; 4 from South Coronado Island, Baja California, NYZS 28823; 72 from i Rock, San Diego, California, including UMMZ 63947; 3 from La Jolla, fornia; one from the entrance to Newport Bay, California; 3 from San ente Island, California, CAS 12966; one from Portuguese Bend, Los An-es County, California.

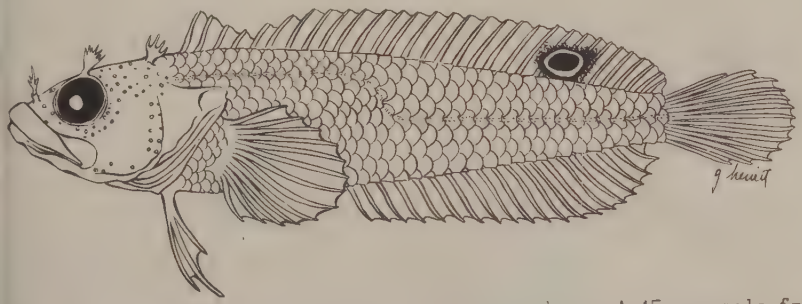


FIG. 23. *Paraclinus integripinnis zacae*, n. subsp. A 45-mm. male from 414.

Paraclinus integripinnis zacae Clark Hubbs, new subspecies
Figure 23

mnobates integripinnis (nec Rosa Smith) Jordan, 1885b, p. 390 (in part); Rosa Smith, 1885b, p. 553.
henopterus integripinnis (nec Rosa Smith) Starks and Morris, 1907, p. 237 (in part).

This new subspecies has a statistically longer first dorsal spine than es *P. i. integripinnis* (Graph 30). The proportion of tenth dorsal spine standard length is likewise statistically greater in *P. i. zacae* than in California subspecies (Graph 31). When these 2 lengths are plotted in rcents of standard length, there is no overlap in their standard deviaons (Graph 32). In all 3 comparisons the mainland specimens cannot be parated statistically from those from off Guadalupe Island. The area of tergradation cannot be defined here since too few specimens have been ken from localities between the international boundary and Point San Fuio, Baja California. The 5 specimens from San Telmo Point, however, apar to be intergrades since they are intermediate in the above tabulations. e 2 subspecies can be further distinguished since *P. i. zacae* has a statistically greater number of orbital cirri in each size group for which an equate sample is available (Graph 33); in this table, again, intergrades e intermediate. If the number of dorsal and anal rays are added to the mber of lateral line scales, *P. i. zacae* has a statistically smaller to-l than does the northern subspecies (Graph 34); in this tabulation interades agree with *P. i. integripinnis*.
Named *zacae* for the yacht *Zaca*.

The 44.5-mm. holotype (SU 16230) was collected by Carl L. Hubbs a party from the *E. W. Scripps* on December 8, 1946, from a tide pool at th south end of Guadalupe Island. The following 102 specimens, from 21 t 53 mm., are designated as paratypes: 50 from Guadalupe Island, USNM 15199 CAS 20463, SU 16231, and TNHC 423; one from West Benito Island, Baja Cal ifornia, NYZS 28819; 18 from Abreojos Point, Baja California, CNHM 5143 16 from the west point of Ballenas Bay, Baja California, TNHC 414; one fr San Cristobal Bay, Baja California, SU 1899; and 17 from the vicinity Port San Bartolomé, Baja California, USNM 151994, CAS 20462, and SU 16233.

The following 5 specimens, from 50 to 53 mm., from San Telmo Point, Ba California, are considered as intergrades: SU 16232 and CAS 19550.

FIG. 24. *Paraclinus walkeri*, n. sp. Male and female, ca. 50 mm. sta dard length, from TNHC 437.

Paraclinus walkeri Clark Hubbs, new species
Figure 24

Dorsal XXXI to XXXIII (XXXII); anal II, 18 to 20 (19 to 20); total do sal and anal rays 51 to 55 (52 to 54); caudal 11; pectorals 12 to 15 (13 pelvics I, 3; branchiostegal rays 6 to 7 (7); lateral line scales 35 to (36 to 38); scale rows from anal posteriorly to lateral line 5 to 6 (6 scale rows from dorsal posteriorly to lateral line 2 to 5 (4); gill rake 2 + 4.

Head and snout bluntly pointed. Jaws equal or lower projects slightl The projecting lips about 1.5 times suborbital. Upper jaw in females a young reaches to a point below middle of eye, in males to a point below posterior margin. Maxillary expanded dorsally in males; its depth equal suborbital width in young and females, to twice that distance in adu males. Interorbital space flat to gently concave. Posterior margin preopercle located at about three-fifths the way back along postorbi bony length. Cirri on head about one-half eye diameter in adults.

The profile is concave as it rises gently from snout to nape and th

fifth spine, from which it drops gently to twenty-fourth spine, then e rapidly to horizontal caudal peduncle. Peduncle short and deep. Body pressed, especially posteriorly.

First dorsal spine originates above a point one-third the way back on rcle. All spines sharp and inflexible. First three slightly stouter n the remainder; first spine short, second and third yet shorter; fourth same length as third, fifth and sixth each slightly longer than preced- spine. The fin then levels off to last 2 spines, which are shorter. its entire length last spine is bound down by a membrane, attached efly to caudal peduncle but in part to caudal fin. The spines become ogressively farther apart anteriorly to fourth spine. Distance between ird and fourth spines, as well as that between second and third, almost ice as great as that between fourth and fifth spines; first two spines parated by a space equal to half of that between second and third spines. l spines bear flags. Membranes slightly incised, especially those be- een third and sixth spines; that between third and fourth spines incised e-half.

First anal spine contained 1.2 and 2.2 times in second spine and first ft ray respectively. Length of soft rays gradually increases to last 2, ich are shorter. Tips of last rays extend much farther beyond caudal se than do dorsal spines, and last ray is attached by a membrane to cau- l peduncle only at its extreme base. Membranes incised one-third.

The ninth ray of the bluntly pointed pectorals the longest, the lower ys stouter than the upper ones. Second ray of the long and pointed pel- cs the longest, the third the shortest, but separated from second by a embrane distally. Membrane between first and second rays incised one- ird.

No posterior, fleshy projections on the scales. The scales have radii ly on their anterior surfaces, as shown in Fig. 15.

Scales on anterior arc of lateral line have no external pores, for each pening lies under next anterior scale. Most of the scales, however, have light mark which seems to be a vestige of an external opening, as shown in ig. 18. The posterior scales have a pore at each end of a tube, as shown n Fig. 17.

The colors as exhibited by both fresh and preserved specimens are more onstant than in most other members of the genus. In life these fish were lackish with red spotting. Ground color dark (brownish to reddish above ateral line and grayish below). Seven faint, irregular crossbars on body o not extend to belly but continue onto the light-margined dorsal fin. A lack ocellus with a white circle around it on the membranes between twenty- hird and twenty-fifth dorsal spines in the next-to-last crossbar continua- ion. Caudal has a black bar near base, connected to caudal peduncle col- ration by a broad band. Two clear areas border this band. Distal to the ar are many dark spots on the rays which form irregular crossbars, becom- ng more and more irregular distally. The light-bordered anal is dark with more-to-less obscured continuations of the body crossbars, with even ainter dark bars between them. Pectoral base blotched. A black spot at ase of fifth ray and another at base of seventh; these may fuse into one larger spot. Proximal one-third of fin reddish or blackish, followed by a large, prominent, black spot on ninth ray. Distal part of fin colored like distal part of caudal. Pelvics dark proximally and colored like caudal and pectoral distally. Head dark. Nape cirri black with red tips. Five dark spokes around eye: posterodorsal, dorsal, anteroventral, ventral, and pos- terior. The dark jaws and margin of preopercle mottled with whitish pos- teriorly. Underside of head light, mottled with dark.

This species has been found only in San Quintin Bay, Baja California. It is probably found nearer to the head of the bay than to the mouth, as it was taken only at the 2 collecting stations farthest from the mouth. The

fish live in sponges found on sand bottom under natural conditions, but most were taken from the same sponges attached to the pilings of an old pier.

Named *walkeri* for Boyd W. Walker.

The 66-mm. holotype (SU 15320) was collected on an expedition of the Stanford Natural History Club on March 24, 1949, from a mud flat 1500 meters northwest of Laguna Point, San Quintin Bay, Baja California. The following 106 specimens, from 23 to 57 mm., are designated as paratypes: one from the type locality, USNM 151995, and 105 from the old pier in San Quintin Bay, Baja California, TNHC 437 and SU 15224 and 15239.

Genus EXERPES Jordan and Evermann

Exerpes Jordan and Evermann, 1896b, p. 232 (type species by original designation *Auchenopterus asper* Jenkins and Evermann, 1889).

This genus may be separated from all other clinids by: a spinous process on opercle; reduced number of dorsal soft rays (0 to 2); long, pointed snout; absence of cirri on nape; completely separated, ribbon-shaped first dorsal; and the presence of typical posterior type of lateral line openings on the anterior arc of lateral line.

Since only one species, *asper*, is recognized, further description will be found under that heading.

Exerpes asper (Jenkins and Evermann)

For synonymy see subspecies

Dorsal III to IV (III)-XXIII to XXVI (XXIV to XXV), ½; anal II, 17 to 2((18 to 19); total dorsal and anal rays 45½ to 50½ (47½ to 49½); caudal 11 pectorals 13 to 15 (13); pelvics 0,0; I,1; I,2; and I,3 (I,3) (third ra very hard to see in young); branchiostegal rays 5 to 7 (6); lateral line scales 37 to 46 (38 to 43); scale rows from anterior end of anal fin posteriorly to lateral line 6 to 8; from anterior end of dorsal fin posteriorly to lateral line 3 to 7 (3 to 6); gill rakers 3 + 8.

Head elongated, compressed, and pointed, as is snout. The terminal an projecting lips contained 1.6 times in suborbital. Lower jaw projects beyond upper. The short maxillary does not extend to anterior margin of eye The small, round eye does not enter dorsal profile. Interorbital flat t slightly W-shaped. The elongate opercle armed with a spine on its upper margin. The angular preopercle smooth with a slight posterior projectio at base of opercular spine. No cirri on head unless a flap on anterio nostril is so considered.

Conical teeth present on premaxillaries, mandibles, and vomer but absen on palatines. Those on the jaws consist of an outer row of small teeth an an inner band of smaller teeth. Vomer has only a band of smaller teeth.

The profile rises evenly and gently from snout to nape, more steeply t first dorsal spine, then less steeply to origin of second dorsal fin. A long second dorsal the gently curved profile slowly declines to caudal ped uncle, which is horizontal. Peduncle about as deep as long. Body strongl compressed but not very deep.

The first dorsal originates above a point just behind preopercle. Firs 3 dorsal spines long, thin, and flexible; others snorter and inflexible First 3 spines are separated from the rest to form an anterior dorsal fin first and second spines elongate, the third considerably shorter, eve snorter than the longest spines of second dorsal. First spines of secon dorsal very short; the spine lengths increase posteriorly as far as third from-last, then decrease. The single soft ray, however, projects slightl

yond fin margin. Tips of last rays extend almost to caudal base, and ft ray is bound down for its entire length by a membrane attached to cau- l peduncle. First dorsal spines set close together, with a distinct gap tween the membrane behind third spine and first spine of second dorsal n. Anterior spines of second dorsal set farther apart than posterior es. Membranes on first dorsal fin not incised between spines. Anterior mbranes on second dorsal incised one-third, becoming gradually less in- ised posteriorly so that last few are not incised. All spines bear small lags.

First anal spine slightly stouter than spines of second dorsal. Second nal spine very long and stout—the largest spinous ray (in gross size). irst anal ray slightly longer but much thinner than second spine, the other ays all slightly shorter except for last one, which is much shorter. Tips f last rays extend onto caudal base, the last ray strongly attached by a mbrane to caudal peduncle.

Pectorals short and fan shaped, with no very small rays. Membranes not ncised. Upper rays not fleshier than the lower. Second ray of the long elvics only slightly longer than the first. Third ray very thin, must be issected to be seen, but despite its thinness is almost as long as second ay.

gure 25

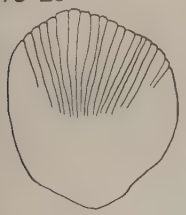


Figure 26

Figure 27

FIGS. 25-27. *Exerpes asper*. Fig. 25. Body scale. Fig. 26. Anterior lateral line scales. Fig. 27. Posterior lateral line scales.

Body covered with large, imbricate scales. Those on the belly, pectoral base, extreme base of caudal fin, and nape smaller than the others. Head, pelvic base, and all other fins naked. The scales have radii on their anterior margins only (Fig. 25).

The lateral line follows a very irregular course from upper margin of opercle, up almost to origin of second dorsal; it then runs ventrad to midline, then straight to caudal. Scales on anterior arc bear a pore at each end of a tube (Fig. 26), a condition typical in the posterior lateral line segment of most clinids. Lateral line scales on the anterior arc frequently separated by scales without pores. As lateral line drops to midline, a new type of pore appears: a single, very minute opening in center of scale, very difficult to see. Usually, at the beginning of the straight section there are more scales with double pores than scales with the small pores, but the latter are more common posteriorly (Fig. 27). Few pores on head; suborbital canal absent, and all other canals bear only a single row of pores.

The color pattern is described from field observations of *Exerpes asper earli* and aquarium observations of *E. a. asper*. Since the patterns are essentially similar, it is assumed that all subspecies have the same color pattern. Basic ground color dark olive, but in some specimens, especially

large adults, the olive is replaced by varying amounts of reddish orange. A longitudinal, black stripe extends backward from snout, fading out near caudal peduncle. A silver streak below it fades out posteriorly; an olive band, starting at anterior base of anal, enlarges posteriorly at the expense of the silver streak. Belly silver with some olive blotches. Superposed upon this pattern is a series of 6 faint, dark, vertical bars which connect with similar, more distinct bars on the vertical fins. First dorsal olive with a clear posterior margin; second dorsal clear with 5 olive blotches: one is on each end of the fin; the third and fifth have a black ocellus with a yellowish-white margin. Caudal light with some faint vertical barring on the rays and a narrow black band near base, connected with last body bar by a central band of dark color. Anal colored like second dorsal, but with only 4 olive blotches, the first on the second spine, the last at posterior end of fin; the last 2 blotches frequently converge into a single large one. On the ventral base of the colorless pectorals an olive blotch interrupts the silver streak. The light pelvics have either 2 or 5 olive-yellow stripes. Head is colored like body, both longitudinal stripes extending uninterrupted across head, the black band passing through eye. Upper jaw has a small, median, white bar.

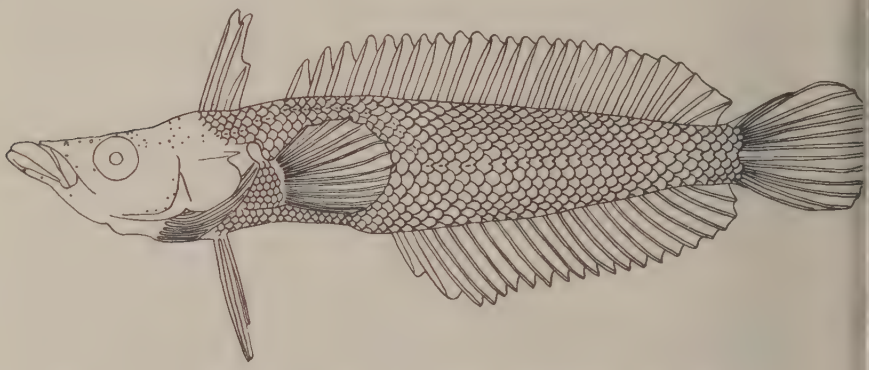


FIG. 28. *Exerpes asper asper*. A 45-mm. specimen from TNHC 415.

This species has a spotty recorded range: the Gulf of California and the bays along the outer coast of Baja California as far north as Scammon Lagoon. Fish of this species probably live in areas between the known localities (especially in the Gulf of California) but too few collections have been made in the proper habitats. Despite the incomplete range data it seems advisable to divide the species into three geographic subspecies *asper* from the Gulf of California, *magdalenensis* from Magdalena Bay, and *earli* from San Ignacio Lagoon, Turtle Bay, and Scammon Lagoon. None of the specimens examined appear to be intergrades.

Present evidence indicates that this species lives in a reticulated alga. The specimens from San Ignacio Lagoon were collected in association with examples of that plant, which is frequently found in conjunction with eel grass. All of the large series collected are recorded as having been taken from eelgrass beds, which are suspected to have contained large amounts of reticulated algae when the collections were made. This species occurs in frequently along rocky coasts; however, specimens were taken from low tide pools at Punta Peñasco, Sonora, Mexico, and from rocky bottom at one fathom in Santa Inez Bay. From its habitat and general physical appearance th

sh was thought to be an eelgrass mimic. This hypothesis was borne out en some live specimens from Guaymas, Sonora, Mexico, were examined at the einhart Aquarium. They usually swam very slowly at an angle of forty- ve degrees with the anterior end up. The pectorals were the chief means propulsion when in this position. The first dorsal was held erect. The ecies is probably solitary as the fish were constantly nipping each her; when nipped, they frequently darted away in a more conventional man- er, using their caudal fins.

Sexual dimorphism in this group is not striking; there is a slightly reater distance between the anal and pelvic bases in females than in males.

Exerpes asper asper (Jenkins and Evermann)
Figure 28

uchenopterus asper Jenkins and Evermann, 1889, p. 154 (type locality Guaymas, Mexico; holotype USNM 39643).—Evermann and Jenkins, 1891, p. 163, pl. 2, fig. 6.—Vaillant, 1894, p. 75.
xerpes asper Jordan, 1896, p. 232.—Jordan and Evermann, 1896a, p. 469; 1898, p. 2357.—Osburn and Nichols, 1916, p. 178.—Jordan, Evermann and Clark, 1930, p. 456.—Fowler, 1944, p. 520.

Apparently this subspecies is distributed in suitable habitats over the ntire Gulf of California. First dorsal spine longer than in *E. a. earli*; hen the proportion of this spine to standard length is plotted, the stand- rd deviations of the two subspecies do not overlap (Graph 35). *E. a. asper* as a shorter head than *E. a. magdalenensis;* when the proportion of head to standard length is plotted, the standard deviations of the two subspecies do ot overlap (Graph 36). The upper jaw length is intermediate; it is sta- istically shorter than that of *E. a. magdalenensis* and statistically long- r than that of *E. a. earli* (Graph 37).

The 38-mm. holotype (USNM 39643, collected by O. P. Jenkins and B. W. vermann from Guaymas, Sonora, Mexico), one paratype (CAS 7769 with the ame data), and the following 77 other specimens, from 29 to 57 mm., were xamined: 69 from Ensenada Bocochibampo, Sonora, Mexico, CAS 18478, TNHC 115, and USNM 152013; 4 from the vicinity of Rocky Point (Punta Peñasco), Gulf of California, CAS 20498, CNHM 51445, and SU 16236; and 4 from Santa inez Bay, Gulf of California, NYZS 25314 and SU 16235.

Exerpes asper magdalenensis Clark Hubbs, new subspecies

Although geographically this subspecies is somewhat intermediate between *E. a. asper* and *E. a. earli*, it is extreme in enough morphological characters to rule out the possibility that the specimens are intergrades between the other two subspecies.

Exerpes asper magdalenensis is separated from *E. a. asper* under that heading. It has a longer head than *E. a. earli*; when the proportion of head to standard length is plotted, there is no overlap in the standard deviations (Graph 36). *E. a. magdalenensis* has a longer upper jaw than *earli*; when the proportion of upper jaw to standard length is plotted, there is no overlap in the standard deviations (Graph 37). The Magdalena Bay subspecies has a statistically longer first dorsal spine (Graph 35) and caudal peduncle (Graph 38) than *earli*.

The subspecies is known from but one locality. The series was found in the uncatalogued collections at Stanford University with a label: "Clupeid Larvae, Magdalena Bay, Lower California." It is assumed that the geographical data on the label were correct, if the identity was not.

Named *magdalenensis* for its probable type locality.

The 46.8-mm. holotype (SU 16237) and 12 paratypes, from 22 to 42 mm., (SU 16238) were taken from Magdalena Bay, Baja California.

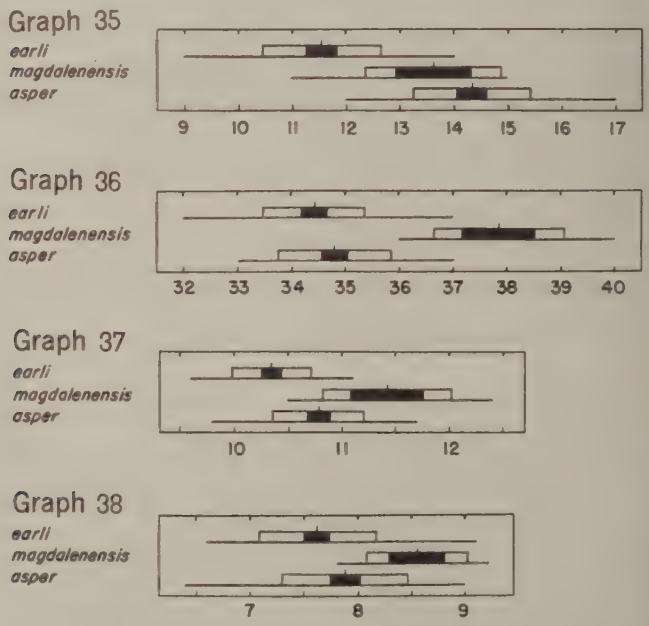
Exerpes asper earli Clark Hubbs, new subspecies
Figure 29

This subspecies is extreme not only geographically but also in enough morphological characters to rule out the possibility that it represents intergrades.

It is separated from the other two subspecies under their own headings.

The specimens from the two southern localities agree very closely in all morphological characters checked. The two specimens from Scammon Lagoon are too poorly preserved for detailed study but apparently belong to this subspecies.

Named *earli* for Earl L. Hubbs, one of the collectors at Turtle Bay, who not only worked very industriously but also put up with the irritability of the other collector.



GRAPHS 35-38. Subspecies of *Exerpes asper*. Graph 35. Standard length into first dorsal spine length, in percents. Graph 36. Standard length into head length, in percents. Graph 37. Standard length into upper jaw length, in percents. Graph 38. Standard length into caudal peduncle length, in percents.

The 52-mm. holotype (SU 16239) was collected by Clark and Earl L. Hubbs February 8, 1948, from an eelgrass bed three-fourths mile southeast of e Tortolo, Baja California. The following 96 specimens, from 25 to 51 , are designated as paratypes: 85 from the type locality, TNHC 420, S 29822, and SU 16240; and 11 from San Ignacio Lagoon, Baja California, 16241, CAS 20499, and CNHM 51434. Two specimens (SU 16242) from Isla ncha, Scammon Lagoon, Baja California, were not designated as paratypes e to their poor condition.

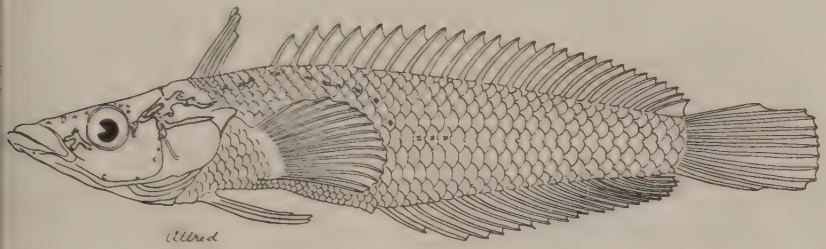


FIG. 29. *Exerpes asper earli*, n. subsp. A 51-mm. male from TNHC 420.

Tribe STARKSIIDI, new

Type *Starksia* Jordan and Evermann.

This tribe consists of small coral-innabiting, viviparous fishes. The rge number of species appear to belong to two or more genera. The genus *annerella* was described from a male of this tribe. Gilbert distinguished e genus by characteristics which separate males from females. However, has not been ascertained whether *Brannerella* was described from a male the genus *Starksia*, or, purely by chance, from a male of another genus. til the position of the type species is determined, the name *Brannerella* st be retained for the second genus in the tribe. The two genera may be parated by the number of pectoral rays (13 in *Starksia* as contrasted with in *Brannerella*).

Genus STARKSIA Jordan and Evermann

Time and space have not permitted a revision of the Pacific species of is large and interesting genus. A preliminary survey of the specimens ailable indicates that there are at least three undescribed species as ll as the type species in Eastern Pacific waters. One of the undescribed ecies is from the Galapagos, another from Guadalupe Island, and the third om deep water off Panama. It has not been determined whether or not spe- es of this genus occur in the Caribbean.

Starksia cremnobates (Gilbert)

This species is apparently restricted to the Gulf of California. Re- ntly caught specimens from shore waters may belong to this species, de- cribed from specimens dredged from 71 fathoms.

Genus ?BRANNERELLA Gilbert

This genus, like *Starksia*, is not revised in this paper. The preliminary survey, however, indicates that there are at least two undescribed species (one Mexican and one Panamanian) of this genus in Eastern Pacific waters (the type species is extralimital). The generic name for these undescribed species remains in doubt, pending a revision of the Atlantic species of the tribe Starksiidi, as indicated above.

Tribe CRYPTOTREMIDI, new

Type *Cryptotrema* Gilbert.

This small group consists of two genera of rock-dwelling fishes from of the coasts of California and Baja California. These fishes in general d not enter the tidal zone but range from just beyond low-tide line to a dept of 50 fathoms. In keeping with such an inaccessible habitat, there is scarcity of specimens in collections. From somewhat inadequate data thi group might be typified as follows: first dorsal spines soft and flexible no pronounced indentations in outline of dorsal fin; principal rays of cau dal fin branched; few cirri on head, from 0 to 5 on nape, 0 to 6 on eye and 0 to 6 on anterior nostril; no copulatory organ in male; opercle ha no spinous process; eyes simple, with no fleshy bar across pupil; 49 to 7 scales in lateral line.

There are two well-differentiated genera, *Cryptotrema* and *Alloclinus* The latter is the shallower-water form, extending from the low-tide leve to 27 fathoms, while adults of the former have been taken at depths rangir from 13 to 50 fathoms. Genera may be separated by Graphs 39 to 46 and t the following key.

KEY TO THE GENERA OF THE CRYPTOTREMIDI

1a. Lateral line extends in straight line posteriorly from opercle to abo one-half distance from snout to tip of caudal, then gradually descenc to midline; less than 55 scales in lateral line (Graph 47); less tha 63 total dorsal and anal fin rays (Graph 48).....ALLOCLINUS (p. 9

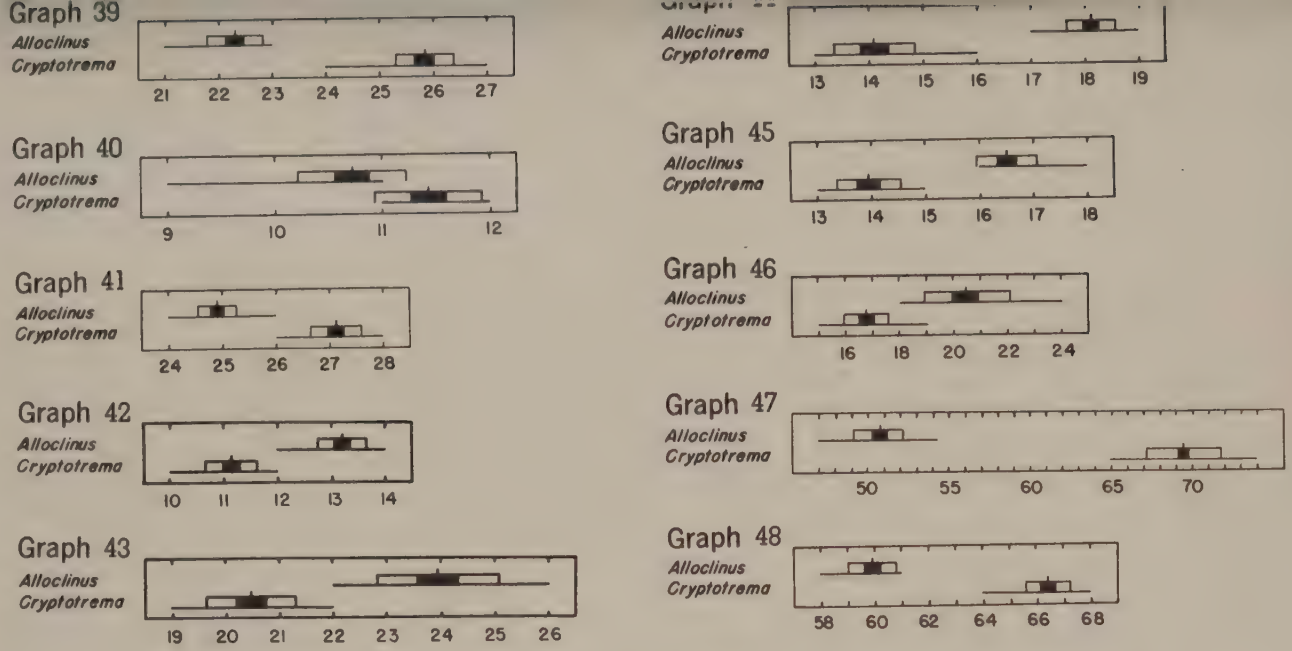
1b. Lateral line extends in straight line posteriorly from opercle to tw thirds distance from snout to base of caudal, then suddenly drops midline; more than 60 scales in lateral line (Graph 47); more than total dorsal and anal fin rays (Graph 48).....CRYPTOTREMA (p.10

Genus ALLOCLINUS C. L. Hubbs

Alloclinus C. L. Hubbs, 1927, p. 351 (type species by original designati *Starksia holderi* Lauderbach).

This genus may be separated from other clinids by the following chara ters: lateral line extends posteriorly in a gentle arc for 24 to 25 scale then drops slowly to midline, which it follows to caudal peduncle; all a terior lateral line pores open under scales; first 2 or 3 dorsal spin soft and flexible; remainder sharp and inflexible; principal caudal ra branched.

There is but one species, *holderi*. The 5 slightly aberrant specime dredged off Guadalupe Island, Mexico, are the only specimens known to ha been taken from more than 3 fathoms of water. They may be members of



GRAPHS 39-48. *Cryptotremidi*. Graph 39. Anal soft rays. Graph 40. Dorsal soft rays. Graph 41. Dorsal spines. Graph 42. Standard length into distance between eye and tip of subopercular spur, in percents. Graph 43. Standard length into snout-to-dorsal distance, in percents. Graph 44. Standard length into nape-to-mandible distance, in percents. Graph 45. Standard length into second dorsal soft ray length, in percents. Graph 46. Standard length into body depth, in percents. Graph 47. Lateral line scales. Graph 48. Sum of dorsal and anal fin rays.

deeper-water form. The differences, chiefly more slender spines and cirri are not sufficient to distinguish these few slightly battered specimens subspecifically from the others.

Alloclinus holderi (Lauderbach)

Starksia holderi Lauderbach, 1907, p. 75, fig. 6 (type locality probably Santa Catalina Island, California; holotype USNM 50737).—Starks and Morris, 1907, p. 237

Alloclinus holderi C. L. Hubbs, 1927, p. 352.—Jordan, Evermann and Clark, 1930, p. 456.—Barnhart, 1936, p. 85, fig. 254.

Dorsal VVIV to VVVI (VVV), 9 to 11 (10 to 11); anal II, 21 to 25 (22 to 23); total of dorsal and anal rays 58 to 61 (59 to 61); caudal 10 to 12 (11); pectorals 13 to 14 (14); pelvics I, 5; branchiostegal rays 5 to 6 (6); lateral line scales 47 to 54 (46 to 55); scale rows posteriorly from the anterior end of the anal fin to the lateral line 8 to 11; from the anterior end of the dorsal fin 4 to 7 (6 to 7); 4 + 9 short and weak gill rakers.

Snout pointed. The slightly projecting, terminal lips contained 1.5 times in interorbital. Maxillary extends to a point below posterior one-third of eye. The round eye slightly projecting. Interorbital space flat to slightly concave. Opercle without spines. Posterior margin of angular preopercle slightly more than midway in postorbital bony length. Cirri few to moderate in number: from one to 5 on nape, 2 to 6 over eye, and one to 3 on anterior nostril; all divided nearly to base; longest just exceed interorbital width.

Conical teeth present on premaxillaries, mandibles, vomer, and palatines. The jaws have a row of enlarged outer teeth and an inner band of smaller teeth. Vomer and palatines have a single row of larger teeth.

The profile rises evenly to eye, from which it levels off to base of soft dorsal, except for a slight hump from nape to twelfth dorsal spine then drops along base of soft dorsal rays to short and deep caudal peduncle. Body somewhat compressed.

First dorsal spine originates above posterior margin of preopercle. First 2 or 3 spines thin and flexible, the others thin and inflexible. Dorsal fin outline smooth, with a slight incision at third or fourth spine after which the spines lengthen gradually to about the fifteenth, then shorten slowly to last spine, which is more than one-half length of longest spine. The soft rays higher than spines (more than twice length of last spine). The dorsal soft rays remain long up to the last 5, which rapidly decrease in length. Tips of last rays extend to base of caudal, but last ray is not attached to caudal peduncle. Membranes slightly incised. Spines show traces of flags. Spines and rays equally spaced.

The principal rays of the rounded and truncate caudal fin are branched.

The first anal spine inflexible, twice interorbital width, and goes 1.6 and 1.7 times into second spine and first soft ray respectively. Soft rays gradually increase in size up to the last two, which are much shorter. Tips of last rays extend as far as base of caudal fin, but last ray not attached by membrane to caudal peduncle. Membranes incised one-third.

The ninth ray of the pointed pectorals the longest. Membranes slightly incised. Lower rays noticeably thicker than upper. The second pelvic ray the longest; the third splinted to the second. Membrane between first and second incised one-third.

Body covered with large, imbricate scales. Head, pelvic base, and all fins except proximal portion of caudal naked. The scales have radii only on their anterior margins (Fig. 30).

.l pores in the anterior part of the complete lateral line open under
es (Fig. 31); posteriorly, there are 2 pores per scale, the posterior
opening under the scale, the anterior penetrating the center of the
e (Fig. 32). Lateral line extends posteriorly in a gentle arc from up-
margin of opercle for 24 to 28 scales, then gently descends to midline
from there runs straight to caudal base. Few pores on head; a double
on mandibular and suborbital canals.

Figure 30

Figure 31

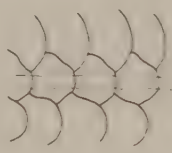
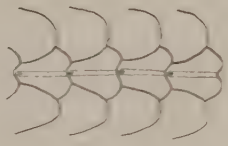


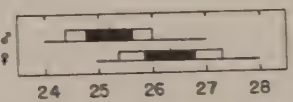
Figure 32



IGS. 30-32. *Alloclinus holderi*. Fig. 30. Body scale. Fig. 31. Anter-
lateral line scales. Fig. 32. Posterior lateral line scales.

The life colors of this species are more consistent than those of the
jority of the clinids. Light gray, lengthwise stripes on upper sides of
y follow centers of scale rows; red stripe between each gray stripe.
tral surface an even olive violet. Six dark brownish-black bars on the
es extend from below lateral line on each side across back and onto dor-
fin. Dorsal fin orange red. Dorsal and anal fins light bordered.
dal reddish; anal greenish. Pectoral yellowish with dark red spots at
e. Yellowish pelvic has pale base and tip. Top of head mottled pur-
sh and cream. Blue gray opercles have a red margin. Two or 3 red dashes
ind eye. Center of upper jaw red.

This species has a rather wide range: from Cape Tortolo and Guadalupe
and, Baja California, to Santa Catalina Island, California. While this
er was in press Dr. C. L. Hubbs (personal communication) reports the
ture of this species from Santa Cruz Island, California. All of the
cimens except the Cape Tortolo one were collected from off-shore islands,
gesting that these fish may be relicts of a much larger population. The
cimens were taken in rocky areas from the extreme low-tide level to 27
noms.



GRAPH 49. Secondary sexual dimorphism in *Alloclinus holderi*. Distance
tween anal base and pelvic base.

A significant secondary sexual differentiation was noted in the distance
m anal base to pelvic base (Graph 49).

The 78-mm. holotype (USNM 56[illegible]) from Avalon, Santa Catalina Island (?),
lifornia, and the following 40 other specimens, from 44 to 97 mm., were
mined: one from a tide pool on Cape Tortolo, Baja California, SU 16244;
from tide pools on Guadalupe Island, Baja California, CAS 20700; 5
edged from 12 to 27 fathoms off Guadalupe Island, Baja California, SU

16245 and TNHC 448; 5 from tide pools on South Coronado Island, SU 153 and 15393; 5 from tide pools on San Clemente Island, RUC and SU 15392; from Santa Catalina Island, SU 16243, TNHC 418, and USNM 152014, and o without locality data, USC.

Genus CRYPTOTREMA Gilbert

Cryptotrema Gilbert, 1890, p. 101 (type species by monotypy *Cryptotre corallinum* Gilbert).

This genus may be separated from other clinids by the following combin characters: the lateral line extends posteriorly in a straight line for to 50 scales, then drops sharply to midline, along which it extends to ba of caudal fin; all the anterior lateral line pores open under scales; t first 3 dorsal spines soft and flexible; the remainder sharp and inflex ble; principal caudal rays branched.

There is only one species, *corallinum*, and a more detailed descripti will be found under that heading.

Cryptotrema corallinum Gilbert

Cryptotrema corallinum Gilbert, 1890, p. 101 (type locality *Albatro* Station 2945; holotype USNM 48257, here designated from 4 cotypes). Jordan and Evermann, 1896a, p. 469; 1898, p. 2366.—Starks and Morr 1907, p. 237.—Starks and Mann, 1911, p. 16.—C. L. Hubbs, 1916, 165.—Fowler, 1924, p. 294, 300.—C. L. Hubbs, 1927, p. 364.—Bar hart, 1936, p. 85, fig. 255.

Chryptotrema corallinum Jordan, Evermann and Clark, 1930, p. 456.

There has been considerable confusion as to the identity of the t specimen of this species. In the original description Gilbert (1890) li ed 3 specimens of *Cryptotrema corallinum* from *Albatross* Station 2945 "cotypes." In this investigation 4 specimens have been found which, a cording to their labels, are from this station. These labels also list 4 as cotypes or holotypes. They are USNM 48257 and 43090 and SU 75 (2 s cimens). It is believed that one of these 4 was removed for drawing thus was absent when Gilbert described the species. Since this speci cannot be determined, all 4 are considered as original cotypes. USNM 48 is here designated as the holotype, and the other 3 become paratypes.

Dorsal XXVI to XXVIII, 11 to 12; anal II, 24 to 27 (26); total dor and anal rays 64 to 68 (65 to 67); caudal 10 to 13 (11); pectorals 13 to (14); pelvics I, 3; branchiostegal rays 6; lateral line scales 65 to 75 to 73); scale rows from the anterior end of the anal fin posteriorly to lateral line 13 to 16, from the anterior end of the dorsal fin 3 to 6; 4 + short and weak gill rakers.

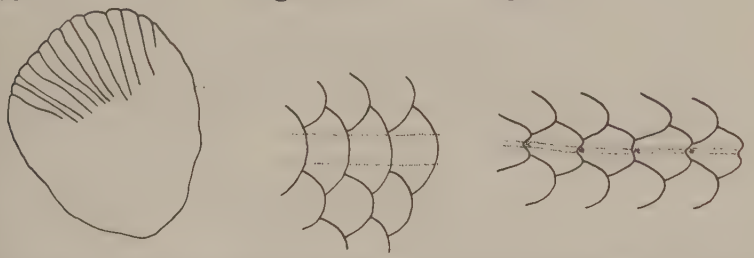
Head and snout pointed. The slightly projecting and terminal lips about 1.3 times into interorbital width. Maxillary extends to anter one-third of the round eye. Interorbital flat. Posterior edge of oper smooth. Posterior edge of the angular preopercle slightly anterior to m point of postorbital bony length. Cirri few: 0 to 3 on nape, 0 to 4 c eye, and one to 2 on anterior nostril; all split nearly to base and sli ly shorter than interorbital width.

Conical teeth present on premaxillaries, mandibles, vomer, and palati Those on jaws consist of a row of enlarged outer teeth and an inner ban smaller teeth. Vomer and palatines have a single row of enlarged teeth

The profile rises evenly to eye, then levels off and, except for a sl

ease at nape, continues level to soft dorsal rays, along which it drops audal peduncle, where it is horizontal.
irst dorsal spine originates over middle of opercle. First spines thin flexible, the others thin and inflexible. Dorsal fin outline smooth; ight incision at fourth spine, after which there is a gradual rise up bout the fifteenth, then a slow decline to the last spine, which is than one-half length of longest spine. Soft dorsal rays higher than al spines (twice length of last spine) to the last 3 rays, which pro- sively become markedly shorter. Tips of last dorsal rays extend to of caudal fin, but last ray is not attached by a membrane to caudal ncle. Membranes not incised. Spines do not bear flags. Spines and equally spaced.
he principal rays of the rounded, emarginate caudal are branched, ex- in the young.
irst anal spine one and one-half times interorbital width and contained and 2.0 times in second spine and first soft ray respectively. Soft gradually increase in length as far as last 2, which are noticeably ter. Tips of last rays extend to base of caudal, but last ray not at- ed by membrane to caudal peduncle. Membranes slightly incised.

igure 33 Figure 34 Figure 35



FIGS. 33-35. *Cryptotrema corallinum*. Fig. 33. Body scale. Fig. 34. erior lateral line scales. Fig. 35. Posterior lateral line scales.

The tenth ray of the pointed pectorals the longest. Membranes slightly ised. Lower rays scarcely thicker than the upper. Second pelvic ray longest; the third is splinted to the second. Membrane between first second incised one-third.
Body covered with large, imbricate scales. Head, pelvic base, and all s except proximal portion of caudal naked. The scales have radii on ir anterior margins only (Fig. 33).
All anterior pores of the complete lateral line open under scales (Fig. . Posterior section has two openings per scale; anterior one opens to side in center of scale, the posterior one opens under posterior end of le (Fig. 35). Lateral line extends posteriorly from upper margin of op- le in a straight line for 45 to 50 scales, then drops sharply to midline about 3 scales, and from there runs straight to caudal base. Pores on d few; a double row along mandibular and suborbital canals.
The color pattern as exhibited by alcohol specimens and one freshly ght young is rather consistent. Ground color olive, with 6 primary, p reddish bars (the first behind pelvic base, the last at base of cau- l) and 5 orange secondary bars. The 11 bars extend onto dorsal and anal steriorly but are obscured anteriorly by the darker fin coloration. An terrupted longitudinal, bright blue stripe below middle of side and ner blue marks, mostly bordering the dark bars. Belly is light. Caudal

has a bright lemon-yellow, submarginal band and considerable yellow at t base. Anal fin largely yellow posteriorly. A round spot at base of thi pectoral ray (faded in alcohol specimens, dark in formaldehyde specimens Top of the head lavender red behind eyes, with a bright blue bar extendi upward and backward from eye. Two light bars run from anterior ventr margin of eye to the tip and to the middle of upper jaw.

This species has a limited recorded range: from San Martin Island, Ba California, to Santa Cruz Island, California. It has always been collect away from the mainland; all specimens are from stations closer to offsho islands than to the mainland. The habitat is rocky bottom at a depth from 13 to about 50 fathoms; adult specimens, however, have never be taken at less than 20 fathoms. The young are probably pelagic, as a 35-m specimen was taken in a trawl over deep water near Bishop Rock.

No sexual dimorphism was noted.

The 78-mm. holotype (USNM 48257) and 3 paratypes, from 79 to 98 mm (SU 75 and USNM 43098) were dredged by the *Albatross* from 30 fathoms o the east end of Santa Cruz Island, California, on February 6, 1889. T following 36 other specimens, from 34 to 111 mm., were examined: 2 fr San Martin Island, Baja California, CAS 2964 and 2965; one from 13 fathc off South Coronado, Baja California, TNHC 421; one from the surface miles east-northeast of Bishop Rock, California, UMMZ 64173; 10 from 21 50 fatnoms off Long Point, Santa Catalina Island, California, USC; 16 fr 20 to 40 fathoms off the east side of Santa Barbara Island, Californi USC; 2 from 30 to 40 fathoms off San Nicolas Island, California, CAS 19 and SU 22970; 2 from 47 to 77 fathoms (specimens probably collected fr shallow end of haul) off Anacapa Island, California, USC; and 2 without cality data, USC.

Tribe LABRISOMIDI, new

Type *Labrisomus* Swainson.

Not enough specimens of this large and diverse tribe have been exami to determine its exact boundaries. The group as a whole was first worl on by Swainson (1839). He separated it from the genus *Clinus* as the ge *Labrisomus* (although three members were included which did not belong the group). Swainson (1839:75) designated *Clinus pectinifer* Cuvier Valenciennes as the type species. Gill (1860) regrouped the species cluded in the genus *Labrisomus* by Swainson in *Malacoctenus, Gobioclinu Blennioclinus, Auchenionchus* (original spelling *Anchenionchus*, presu to be a misprint), *Calliclinus, Ophthalmolophus*, and *Labrosomus* = *Labri mus*. All of these genera except *Labrisomus* were described as new in Gil paper. He designated *Clinus delalandii* Cuvier and Valenciennes (1836) the type species of *Malacoctenus*; *Clinus gobio* Cuvier and Valencien (1836) as the type species of *Gobioclinus; Clinus brachycephalus* Cuvier

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[6]Since the original description by Cuvier and Valenciennes no additio specimens of *Gobioclinus gobio* have been recorded. This species is v probably based on specimens belonging to the Tripterygiidae. The origi description characterized the lateral line as dorsal in position, end suddenly above the tips of the pectorals. One large group of the tripte gids has a pronounced lateral line which extends in a dorsal position the tips of the pectorals and then is discontinued only to reappear on midline as a series of inconspicuous pores. These posterior pores mi easily have passed unnoticed by Cuvier and Valenciennes. The other cha teristics of the species (a blunt, depressed head, large eyes, small num of dorsal rays, and large scales) all are quite common in the Tripteryg dae. Furthermore, Mocquard (1889), who presumably examined the types placed the other members of Swainson's *Labrisomus* in the genus *Clinus*, lieved that *Gobioclinus* was a distinct genus. For these reasons the ge *Gobioclinus* is placed in the family Tripterygiidae and tentatively incl in the synonymy of *Tripterygion* Risso.

enciennes (1836) as the type species of *Blennioclinus; Clinus variolosus* er and Valenciennes (1836) as the type species of *Auchenionchus; Clinus guttatus* Cuvier and Valenciennes (1836) as the type species of *Calliclinus*; and *Clinus latipinnis* Cuvier and Valenciennes (1836) as the type cies of *Ophthalmolophus*. Gill correctly assumed that *Blennioclinus* and *thalmolophus*, the genera which he erected for the two members which be- to the Clinidi, were closely related. These two names have been used many authors for South African genera.

Subtribe CALLICLININI, new

Type *Calliclinus* Gill.

Several species of the tribe Labrisomidi have many primitive character- ics. These species all live in the temperate waters off the west coast South America, while more typical members of the Labrisomidi are tropi- fishes.

This new subtribe may be distinguished from the subtribe Labrisomini by presence of branched rays in the caudal fin. This percoid character icates that this subtribe is close to the common ancestor not only of s tribe but also of tne family Clinidae.

Genus AUCHENIONCHUS Gill

Auchenionchus has been recognized as a valid genus only by Abbott (1899) Fowler (1944) since its description. This genus can be distinguished ily from *Labrisomus* by its branched caudal rays and the short, simple rus on the nape. The following nominal species are included within the nus: *Clinus variolosus* Cuvier and Valenciennes (1836), *Clinus micro- rhis* Cuvier and Valenciennes (1836), *Clinus niger* Philippi (1896), and *nus peruvianus* Cuvier and Valenciennes (1836). Of these species *Auchen- chus niger* is believed to be a synonym of *A. microcirrhis* since the ms were separated by Philippi (1896) on the basis of color alone, a aracter which varies greatly within the clinids. *A. peruvianus* was de- ibed from a drawing and is placed here only that it may have a position the classification.

Genus CALLICLINUS Gill

Fowler (1944) has been the only author since Gill to recognize *Calliclinus*, a genus readily distinguished from all other clinids by the presence a median patch of cirri on the nape and 4 soft pelvic rays. It is shown be related to *Auchenionchus* by the branched caudal rays. Only the nominal species *Clinus geniguttatus* Cuvier and Valenciennes (1836) and *Clinus elegans* Cuvier and Valenciennes (1836) are included within this genus. It probable that *Calliclinus elegans* is a synonym of *Calliclinus geniguttatus*.

Genus MYERSICHTHYS, new

The species *Clinus guttulatus* (frequently misspelled *guttatus*) Cuvier d Valenciennes (1836) is related to both *Auchenionchus* and *Calliclinus* t is considered distinct from both. Since no other generic name is applicable to this species, it is here designated as the type of a new genus, *Myersichthys*, after George S. Myers. It can be described as follows: no

anterior hook on pectoral girdle; all dorsal spines stout and rigid; prin cipal caudal rays branched; dorsal XXIV, 11; anal II, 21; 61 lateral lin scales. It may be separated from *Auchenionchus* by the larger number o small cirri on nape (5 as compared with one) and the larger number of pec toral rays (14 or 15 as contrasted with 13). This new genus, moreover has fewer lateral line scale rows which cross an imaginary line from th opercle to the caudal. *Myersichthys* can be distinguished from *Calliclinu* by the absence of a median patch of cirri on the nape and by having 3 pel vic soft rays instead of 4. This new genus, as well as *Calliclinus* an *Auchenionchus*, may be separated from the other members of the Labrisomid by the possession of branched caudal rays. *Myersichthys* also includes th nominal species *Clinus crinitus* Jenyns.

Subtribe LABRISOMINI, new

Type *Labrisomus* Swainson.

The members of this subtribe are all tropical reef fishes. Both genera *Malacoctenus* and *Labrisomus*, are found commonly on both sides of Centra America. Neither genus shows a preference for either coast. Both gener can be distinguished from the Calliclinini by the absence of branched ca dal rays in all species.

Genus MALACOCTENUS Gill

The name *Malacoctenus* is in current use. A brief survey of the gen indicates that there are at least two subgenera, *Acteis* Jordan and *Malacc tenus* Gill. Time and space do not permit a revision here of the large nu ber of species belonging to this genus. The range is from northern Mexi to northern Peru in the Pacific and along many coastal portions of the tro ical Atlantic.

Subgenus MALACOCTENUS Gill

This subgenus apparently contains the majority of the members of t genus *Malacoctenus* in Eastern Pacific waters. A preliminary survey ind cates that in addition to the three described species, eight undescrib species have been collected from the area: one from the Gulf of Panama a Colombia, one from deep water in Panama Bay, three from Central America a Mexico, two from the Gulf of California, and one at present restricted southern Baja California. There are probably as many Atlantic species Pacific in this subgenus.

Malacoctenus zonifer (Jordan and Gilbert)

A large number of the published records for this species refer to one more of the undescribed species mentioned above. The species is apparen restricted to Central America and southern Mexico.

Malacoctenus afuerae (Hildebrand)

This species, placed in *Labrisomus* by Hildebrand, has been collected northern Peru and Ecuador.

Malacoctenus zonogaster Heller and Snodgrass

The species *M. zonogaster* is restricted to the Galapagos Islands. No iation witnin the populations from the different islands was noted.

Subgenus ACTEIS Jordan

One Eastern Pacific undescribed species is tentatively placed in this ɔgenus. The fish occupy the Panamanian province, being recorded from t: Gulf of Panama and northern Ecuador. The other members of the subgenus ɔcur in the Caribbean.

Genus LABRISOMUS Swainson

The genus *Labrisomus* (Gill's change of the spelling to *Labrosomus* is not ɔnsidered justified) remains a large and diverse group which is not re-vsed here for lack of time and space. As in *Malacoctenus* there are pro-ɓbly several subgenera, three of which have names available.

Subgenus LABRISOMUS Swainson

The majority of the species of the genus *Labrisomus* are included here in :e typical subgenus. Future detailed work will undoubtedly result in the i-classification of several species, both Eastern Pacific and Atlantic, ito separate subgenera. In addition to the three described species, there re at least four undescribed species in the Eastern Pacific: one endemic) Socorro Island in the Revilla Gigedo Islands; one restricted to southern ija California; one ranging from southern Baja California to Costa Rica; nd one ranging from Panama to northern Peru.

Labrisomus xanti (Gill)

This name, like *Malacoctenus zonifer*, has been used for a large number f other Eastern Pacific members of its genus. The name *xanti* belongs to ne species that is restricted to the Gulf of California.

Labrisomus philippii (Steindachner)

The fish of the species *Labrisomus philippii* are present in Peru and orthern Chile.

Labrisomus jenkinsi (Heller and Snodgrass)

This species is restricted to the Galapagos Islands.

Subgenus ERICTEIS Jordan

There is little doubt that one undescribed species of this subgenus has been found in Eastern Pacific waters, from Acapulco and Cleopha Island, Mexico.

Subgenus ODONTOCLINUS Reid

Fish of this subgenus are apparently endemic to the Galapagos Islands.

Labrisomus (Odontoclinus) dendriticus (Reid)

No variation was noted among the specimens collected from the variou islands of the archipelago.

Subfamily CLININAE Gill

Type *Clinus* Cuvier.

This subfamily may be distinguished from all other members of the Blen niicae by: a distinct hook on anterior surface of pectoral girdle an scales with radii on all their margins. It differs from most of the Labri sominae in never having a patch of cirri on the nape.

This large group can be separated readily into two tribes. The mos primitive, the Myxodidi, are apparently restricted to the New World. Th Clinidi, on tne other hand, although primarily South African, are circum antarctic and have entered tropical waters in many parts of the Old Worl

KEY TO THE TRIBES OF THE CLININAE

1a. Viviparous; fleshy penis present in males for transmission of sperm.. .....CLINIDI (p. 10
1b. Oviparous; no penis present.....MYXODIDI (p. 10

Tribe CLINIDI (=Family Clinidae of J. L. B. Smith, 1946)

Type *Clinus* Cuvier.

This group of viviparous fishes is distinguished from the Myxodidi the above key. The penis of the males is always fleshy, short, and stou but varies considerably in shape at the tip, and in the types of lob (more than one lobe in most forms). Associated with this variation in t penis there is great variety of body types. Possibly the extreme variabi ity might be explained by explosive evolution (p. 55).

Since this group is not known from the area under discussion, and sin J. L. B. Smith (1946) recently revised the South African species, the tri Clinidi will not be discussed in detail. Smith, on the basis of Sou African specimens, divided the family Clinidae into two subfamilies. (later described a third subfamily, Xenopoclininae, which is here consider as tne subtribe Xenopoclinini.) Because the South African forms are co sidered to be restricted to one tribe, his subfamily groupings are includ in this paper as subtribes.

Subtribe CLININI, new (=Subfamily Clininae of J. L. B. Smith, 1946)

Type *Clinus* Cuvier.

Smith, following Jordan (1923), considered that *Blennius superciliosus* Linnaeus was the type species of *Clinus*. Both authors overlooked the de ignation of *Clinus acuminatus* (Bloch and Schneider) (1801) by Swains (1839:75) as the type species. Gill (1860) described a new genus, *Ophthu molophus*, with *Clinus latipinnis* Cuvier and Valenciennes (1836) as the t

cies. Since Smith included *Clinus acuminatus* in the genus *Ophthalmolo-* s Gill (1860), the latter generic name is considered to be a synonym of *nus*, and all the species included in *Ophthalmolophus* by Smith are here nsferred to *Clinus*. In the same paper Swainson (1839:75) also described ew genus, *Clinetrachus*, and designated *Blennius variabilis* Rafinesque 10) = *Blennius argentatus* Risso (1810) as the type species. In Swain- 's species list (1839:276) *variabilis* is included under *Blennophis* ainson (1836). Since *variabilis* obviously does not fit the characteriza- on of *Blennophis*, it is assumed that this is a misprint, and *variabilis* retained as the type species of *Clinetrachus*. Since *Blennius super- liosus* Linnaeus (1758) was included in the list of species under *Cline- chus*, it seems advisable to place both species included by Smith in the nus *Clinus, i.e., superciliosus* (Linnaeus) (1758) and *robustus* Gilchrist Thompson (1911), in the genus *Clinetrachus* Swainson (1836). This ansfer of species will not necessarily affect the names of the higher oupings since *Ophthalmolophus* was included within the subfamily Clininae Smith. As mentioned above, this group is here ranked as a subtribe, the inini.

Subtribe BLENNIOCLININI, new

Type *Blennioclinus* Gill.

This subtribe equals the subfamily Myxodinae J. L. B. Smith (1946). ith chose *Myxodes* Cuvier (1829) as the type genus of the subfamily because considered *Clinus fucorum* Gilchrist and Thompson (1911) to be a member that genus. Because the South American oviparous genus *Myxodes* is here nsidered as the type genus of the tribe Myxodidi, the name of this sub- ibe of viviparous South African clinids must be changed. Since the genus *ennioclinus* Gill (1860) is not only the oldest but also one of the most mmonly used of the generic names included by Smith in his subfamily xodinae, it is proposed as the type of the new subtribe Blennioclinini.

Genus SMITHICHTHYS, new

The species *Clinus fucorum* Gilchrist and Thompson (1911) has been placed two genera, *Clinus* Cuvier (1817) and *Myxodes* Cuvier (1829). Because is species belongs in either a different tribe or different subtribe than ese genera, neither generic name is acceptable for this species. Because other generic name which includes this species has been proposed, a new eneric name, *Smithichthys*, is proposed for *Clinus fucorum* and is named fter J. L. B. Smith, in honor of his fine work on South African clinids.

This new clinid genus may be distinguished from all other clinid genera y the following: a distinct anterior hook on pectoral girdle; radii on ll scale margins; no cirri over eye; last dorsal spine not shortened; no omerine teeth; no distinct notch between third and fourth dorsal spines; orsal XXVIII to XXX, 4 to 5; anal II, 18 to 20. A description of *Smith- chthys fucorum* (Gilchrist and Thompson) (1911) may be found in Smith 1946:544; 1949:356). It is distinguished from the oviparous genus *Myxodes* y the presence in males of a fleshy penis.

Tribe MYXODIDI, new

Type *Myxodes* Cuvier.

This exclusively New World tribe probably gave rise to the tribe Clin- di (p. 56). Its more primitive condition is immediately evident in its

differentiation from the Clinidi: oviparous young and lack of a penis This group, together with the Clinidi, can be separated from all other mer bers of the Blenniicae by the presence of an anterior hook on the pectora girdle and radii on all margins of the scales.

Further division of the three genera within the tribe into subtribe does not seem to be feasible on the basis of present information. Thes genera, *Myxodes*, *Heterostichus*, and *Gibbonsia*, appear in many respects t have diverged at approximately the same geologic time. They may be dis tinguished by Table 4 and the following key.

KEY TO THE GENERA OF THE TRIBE MYXODIDI

1a. No teeth on vomer; no membrane binding last soft dorsal ray to caud peduncle.....MYXODES (p. 10
1b. Conical teeth on vomer; a membrane binding last soft dorsal ray to ca dal peduncle.
2a. Snout sharply pointed; caudal fin forked; more than 30 anal soft ray 11 or more dorsal soft rays.....HETEROSTICHUS (p. 11
2b. Snout not sharply pointed; caudal fin rounded in adults; fewer th 30 anal soft rays; 10 or fewer dorsal soft rays..GIBBONSIA (p. 11

TABLE 4

Comparison of proportional lengths of *Myxodes schmitti* and *Heterostich rostratus* in percents of standard length

	Myxodes schmitti	*Heterostichus rostratus*
Head length	20	23-30
Snout length	5	6-8
Upper jaw length	7	8-10
Eye length	4	3-7
Eye to tip of subopercle	11	12-15
Eye to preopercle (in line with greatest post-orbital bony length)	4	6-8
Snout to dorsal	14	19-25
Nape to mandible	13	13-16
Interorbital width	3	2-5
First dorsal spine length	5	5-9
Fifth dorsal spine length	4	2-4
Tenth dorsal spine length	4	3-5
Second dorsal soft ray length	10	9-13
Fifth dorsal soft ray length	7	10-12
Length soft dorsal base	11	13-18
Caudal peduncle length	11	5-9
Caudal peduncle depth	6	5-6
First anal soft ray length	6	8-11
Anal base to pelvic base	22	17-28
Longest pelvic ray length	9	9-14
Longest pectoral ray length	14	11-17
Body depth	21	18-24
Head width at junction of mandibular lateral line	8	6-10

Genus MYXODES Cuvier

Myxodes Cuvier, 1829, p. 238 (type species by subsequent designation Jordan, 1917, p. 129, *Myxodes viridis* Cuvier and Valenciennes).
Mixodes (misspelling) Delfin, 1901, p. 93.

This South American genus may be characterized by absence of vomer

th and lack of a membrane binding last dorsal soft ray to caudal pedun-
. Its exact systematic limits are obscure as there are almost no speci-
s available in this country. This scarcity of specimens is unusual in
w of the large amount of work done on the group in the early nineteenth
tury. The center of the range of this genus (Chile and southern Peru)
remained ichthyologically almost unknown since the turn of the century.
author has examined 2 specimens. They are both in the National Museum.
, which is probably *Myxodes viridis* Cuvier and Valenciennes (1836), is
m Chile. The other specimen, from the Galapagos Islands, is undoubtedly
type of a new species. These two species and *Myxodes cristatus* Cuvier
Valenciennes (1836) may be distinguished according to the following
.[7]

Key to the Species of MYXODES

a. Dorsal spines 37 to 38; dorsal soft rays 3; first 3 dorsal spines much elongated.....*M. cristatus*
a. Dorsal spines 35 to 36; dorsal soft rays 5 to 6; first 3 dorsal spines approximately equal to the others.
b. Head short, approximately 17% of standard length; body not deep, approximately 17% of standard length.....*M. viridis*
b. Head longer, approximately 20% of standard length; body deep, approximately 22% of standard length.....*M. schmitti* (p. 109)

Myxodes schmitti Clark Hubbs, new species[8]

Dorsal XXXV, 6; anal II, 24; total dorsal and anal rays 67; caudal 10;
ctorals 12; pelvics I, 3; branchiostegal rays 6; anterior lateral line
ales 24; posterior lateral line scales 40; total lateral line scales 64;
ale rows above lateral line 122.

Head and snout pointed; mouth terminal. The terminal lips equal to sub-
bital in width. Maxillary extends to a point below middle of eye. The
und eye does not enter dorsal profile. Broad interorbital convex. Oper-
e does not bear a spine on its posterior margin. Posterior margin of
unded preopercle slightly anterior to midpoint of postorbital bony length.
cirrus over each anterior nostril and eye, that over nostril may be cleft,
t that over orbit not deeply cleft.

Blunt, conical teeth present on premaxillaries and mandibles, but not on
nes roofing mouth. Tooth pattern on each jaw consists of an outer row of
eth, behind which are one or 2 smaller single teeth.

The profile rises evenly and steeply to nape, where it remains high and
nvex to sixth spine, then levels off and drops gently to about thirtieth
ine, where it declines more rapidly to caudal peduncle, on which it is
ain horizontal. Peduncle long and rather deep. Body strongly compressed;
dth less than half depth behind anus.

Base of first dorsal spine above posterior margin of preopercle. All
ines stout and sharp. First spine equal to, or slightly shorter than,
cond spine. Third, fourth, and fifth progressively shorter. Sixth spine
ual to fifth, and following spines all slightly longer than the one pre-
ding it. Last spines longer than second. Soft rays of dorsal higher
an the spines. The longest (second and third) about 1.3 times last spine.

---

[7] *Myxodes foncki* Philippi (1896) and *Myxodes ocellatus* Cuvier and Valenciennes (1836) are considered here to be synonyms of *Myxodes viridis* Cuvier and Valenciennes (1836).

[8] This form was given this (manuscript) name by G. S. Myers and C. B. Ide, who have kindly permitted me to describe the species.

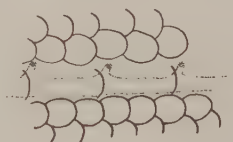
The fin then rounds off toward posterior end. Tip of last ray does not ex tend beyond midpoint of caudal peduncle and is bound down by a membran only at its extreme base. Distance between rays increases progressivel toward anterior end of fin to second spine. Distance between first 2 spine contained 1.5 times in distance between second and third. Spines and ray scarcely incised. The spines bear almost imperceptible flags.

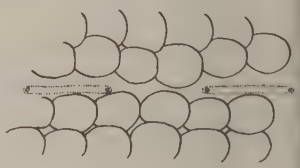
The caudal is damaged so that its shape is not known.

The 2 anal spines similar to those on dorsal fin. First spine containe 1.1 and 2.8 times in second spine and first soft ray respectively. Ra length then increases gradually up to last ray, which is shorter. Tip o last ray does not extend quite so far on caudal peduncle as last dorsal ra and is bound down by a membrane only at its extreme base. Membranes in cised from one-half to two-thirds at midpoint of fin. Interspinous mem brane slightly incised. The spines bear flags.

The seventh or eighth ray of the blunt pectorals the longest. Membrane incised below, but not above. Ventral rays fleshy. Second ray of the shor pelvics the longest, the third is shortest but is distinctly separated fro second by a non-incised membrane. Narrow membrane between first 2 spine incised one-third.

Figure 36 Figure 37 Figure 38





FIGS. 36-38. *Myxodes schmitti*, n. sp. Fig. 36. Body scale. Fig. 3 Anterior lateral line scales. Fig. 38. Posterior lateral line scales.

Non-imbricate scales cover the entire body except posterior base of pe torals and the adjacent area of body. Head naked. Membranes between la 7 spines of dorsal have a small patch of scales anterior to base of ea spine. Extreme base of soft dorsal scaled. A few scattered scales on ba of caudal fin. No scales noted on anal fin. Basal portions of pectora fins heavily scaled for one-third their length. Pelvic fins naked. Th scales have radii on all their margins (Fig. 36).

Lateral line extends posteriorly in a gentle arc from posterior marg of opercle for about 20 scales, then rapidly drops to midline, along whi it runs to caudal fin. The anterior segment has pores which open above t canal (Fig. 37). The posterior section consists of a pore at each end of tube (Fig. 38). Pores on head reduced to one row along each canal.

The colors of this species are probably as varied as those of other me bers of the tribe. Since only one preserved specimen is known, the li colors can be only approximated from it. Body color a uniform orange ye low. Fins all colored like body except soft dorsal, which is slight lighter. Head also orange with 3 black spokes extending from eye: o posterodorsal, a wide posterior one, and a narrow ventral one.

The only specimen, 146 mm., USNM 102008, was taken from Santa Cruz (I defatigable) Island, Galapagos Islands, by W. L. Schmitt on January 1 1935. Undoubtedly this species is restricted to the archipelago.

Genus HETEROSTICHUS Girard

erostichus Girard, 1854, p. 143 (type species by monotypy *Heterostichus rostratus* Girard).

This genus may be separated from all other American members of the Clin- e by the presence of more than 79 dorsal and anal rays. The genus can distinguished further by the sharply pointed snout and forked caudal .

Members of this genus reach the largest size of all the clinids known m the Americas north of the Isthmus of Panama. For this reason they are asionally used for human consumption. As is apparently true of most of Clinidae, the flesh is very palatable; but 2 major objections to its are that it is "bony" and the flesh assumes the external ground color, ch may be purple, orange, or green.

Since this genus has only one species, *H. rostratus*, a more complete de- iption will be found under that heading.

Heterostichus rostratus Girard
For synonymy see subspecies

Vertebrae 21 to 22 + 34 to 36 = 56 to 57; dorsal XXXV to XXXVIII (XXXVII), to 13; anal II, 31 to 35 (33 to 34); total dorsal and anal rays 80 to 87 3 to 86); caudal 11, pectorals 12 to 14 (13); pelvics I, 3; branchio- egal rays 6; anterior lateral line scales 35 to 42 (36 to 40); posterior teral line scales 36 to 45 (37 to 40); total lateral line scales 73 to 83 4 to 78); scale rows above lateral line 215 to 284 (245 to 274); gill kers 5 + 13.

Head sharply pointed; snout long and sharp; lower jaw projects beyond per. The lips, which do not project noticeably, are equal to suborbital dth. Maxillary reaches to below anterior edge of orbit. Eye, which ries from round to dorsally flattened, does not enter dorsal profile. de interorbital flat to gently convex. Posterior margin of opercle is ooth, with a posterior projection above, caused by the suborbital spur. sterior margin of angular preopercle located midway along postorbital ny length; its posterior margin smooth; below the angle, lateral line res reach preopercle edge but do not cause noticeable incisions in its tline. No cirri on nape, and only one short flap, very slightly fringed large adults, present over each eye and anterior nostril.

Conical teeth present on premaxillaries, mandibles, vomer, and palatines. ose on jaws consist of a row of enlarged outer teeth and an inner wide nd of smaller teeth, which become larger toward the midline. Vomer has large, moon-shaped patch of smaller teeth. Palatines have a single or uble row of smaller teeth separated from the vomerine teeth.

The profile rises evenly and gently from snout to nape, with a very ight convex bend above eye; from nape the convex profile rises gently to nth spine, beyond which it becomes even and decreases very slightly as ar as base of first soft rays, then declines more rapidly to caudal ped- cle, where it is horizontal. Peduncle long and rather narrow. Body and ead very strongly compressed, more than twice as deep as wide.

The first dorsal spine originates above middle of opercle. The sharp pines grow more stout posteriorly; the first 3 or 4 spines flexible, but till sharp; first dorsal spine long, longer than all except the last, hich it about equals; the next 4 spines progressively shorter; the sixth bout the same length as, or slightly shorter than, the fifth. A gradual nd gentle increase in length in the next 4 spines, then an even more gen- le increase to the last 3 or 4, which are considerably longer. The soft

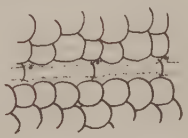
dorsal rays much higher than the spines. The first 5 rays either of al- most-equal height, or middle 3 very slightly longer, the remaining rays al. progressively shorter, forming a rounded fin. Anterior half of last ray projects very slightly from fin outline. Tips of last rays do not approac caudal base. Last ray, for half its length, attached by a membrane to cau- dal peduncle. The rays become farther and farther apart anteriorly. The spines bear flags. Membranes between spines all incised from one-half, between fifth and sixth, to one-fifth, between most spines.

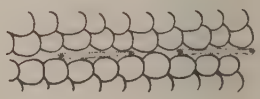
Caudal long and forked.

The 2 anal spines are similar to majority of dorsal spines. First spin goes 1.3 and 2.3 times into second spine and first soft ray respectively. Next 5 or 6 soft rays slightly longer; the rays of central portion of fi shorter than those preceding or following them. Posterior third of fi contains the longest rays, beyond which rays become progressively shorter Tips of the last rays, although extending farther posterior than do thos of the dorsal, do not reach caudal base. For half its length, last ray i bound to caudal peduncle by a membrane. Membranes, more deeply incised i front, have an average incision of about one-sixth.

The seventh ray of the bluntly rounded pectorals the longest. In youn the rays are of uniform thickness but in adults the upper ones are thicke than the lower. Membranes slightly and evenly incised. The pelvics shor and bluntly pointed. All 3 soft rays are almost-equal length; the firs the longest and the third the shortest. Almost no membrane present, th width of fin being derived from width of the rays. The spine, althoug bound to the first soft ray, is not degenerate and is almost half fi length.

Figure 39 Figure 40 Figure 41





FIGS. 39-41. *Heterostichus rostratus*. Fig. 39. Body scale. Fig. Anterior lateral line scales. Fig. 41. Posterior lateral line scales.

The small and imbricate scales first appear in specimens of between mm. and 40 mm. standard length. In adult specimens they cover the enti trunk except the posterior pectoral base and a small adjacent patch on t trunk itself. Dorsal fin has a patch of scales running up the membranes front of all rays, small on first spines and larger posteriorly. Membran of caudal scaled for about half its length. On the membranes in front all rays the anal has patches of scales which resemble those of dorsa These scale patches are large on all except last few rays. Anterior sid of pectoral rays scaled at their bases. Body adjacent to pelvic fin a base of the fin scaled. Head naked except for 2 large patches; the fir bounded by suborbitals, cranium, preopercle, and mandible; the second b tween upper margin of opercle and lateral line. The scales have rad along their entire margins(Fig. 39).

The lateral line runs straight or in an arc from behind upper margin opercle to level of tenth spine, then drops either gently or steeply midline, on which it extends to caudal fin. Each scale on anterior port has an external pore (Fig. 40). The disconnected canals on straight po terior series consist of a tube with a pore at each end (Fig. 41). He

complete series of canals except that superorbital and suborbital canals not unite in front. Each canal above and behind middle of eye has a double row of pores; those in the other 3 quadrants have only a single series of pores.

The color pattern in this species is extremely variable; the patterns of specimens have changed back and forth from barred to striped (2 of the 4 cases) in the aquarium (C. L. Hubbs, personal communication). Intermediate stages between these and the other 2 color phases (plain and mottled) have been found in the field.

In the plain phase, ground color is orange to reddish, with no trunk markings, the belly not noticeably lighter. The fins usually have several transparent "windows." On the dorsal these "windows" are centered around those of the third, sixth, tenth, fifteenth, nineteenth, twenty-fourth, thirty-seventh, and thirty-first spines and posterior end of dorsal soft rays. This last "window" runs proximally along posterior half of fin and covers all the last 2 or 3 rays. Caudal has 2 similar light markings on each fork. Anal has a series of similar light spots centered on the eighth, fifteenth, twenty-second, thirtieth, and last 2 soft rays. These spots seldom, if ever, reach edge of fin. Pectorals lighter than the body. Pelvics similar in color to body. Entire head lighter, especially ventrally and posteriorly.

The striped phase may have a green, purple, brown, or coralline ground color. In any case this ground color is interrupted by up to 6 longitudinal silver stripes. They are, in order of frequency: 1) a broad, very silvery band just below middle of sides, passing through lower third of eye; 2) a broad band from top of eye to posterior base of soft dorsal, but separated from dorsal fin; 3) a broad band from, and including, belly to posterior base of anal fin, but separated from anal fin; 4) a narrow, very silvery band between bands one and 2, extending from a silver spot on upper margin of opercle straight back to base of first soft ray; 5) a narrow band along base of anal; 6) a narrow band along base of dorsal. Dorsal fin is light with 6 dark crossbars centered on the fourth, eleventh, nineteenth, twenty-seventh, and thirty-third spines and the anterior dorsal soft rays. Posterior bar the most prominent and darkest. A light spot on each end of the forks of caudal. Anal colorless except for a dark bar from nineteenth to twenty-sixth rays. Paired fins and their bases colorless to silver. Head silver below eye; some silver along the lateral line from eye to upper margin of opercle. An added silver spot at upper center of opercle. Tips of jaws dark, the rest light.

The third phase (barred) is usually brown or red brown, with similar-colored, darker markings. These markings on body consist of 7 zigzag, vertical bars; the third and fourth clearest. The bars are mottled with light, the interspaces mottled with dark. Bars do not extend to belly or breast. The chief markings on dorsal fin are continuations of the body barring. A clear spot at base of third spine and 2 partially connected ones on posterior half of soft part of dorsal. Caudal mottled with light, forming 2 or 3 obscure, vertical bars. Anal dark, mottled with light. Pectorals light with dark markings. Pelvics dark with light tips and base. Central half of head light or dark but always with two spokes, posteroventral and ventral, below eye; a light band along the lateral line from eye to upper edge of opercle. A light, triangular spot in middle of opercle. Tips of both lips light.

The mottled or fourth phase is usually green, brown, or purple. The ground color on body is interrupted by darker markings of the same color, roughly arranged in 7 vertical and 4 horizontal bands, their centers generally lighter than the ground color, even approaching silvery. Dorsal the same color as the body, mottled with clear and black spots. Clear spots are same as those found on plain phase; dark markings are scattered along

entire fin but are especially prominent on dorsal soft rays. The blac mottlings on caudal especially distinct distally. Anal has same ligh markings as plain phase, frequently lined with black. Along the fin ar black blotches, more distinct posteriorly. The paired fins, colored lik body, have smaller dark markings. Head also marked like body, with th dark markings appearing as spokes around eye, extending from eye postero ventrally, posteriorly, anteriorly, and ventrally. Branchiostegals an posterior portion of the chin light; otherwise ventral surfaces not differ ent from sides.

The postlarvae of about 25 mm. standard length have a prominent, median dark stripe, interrupted by more-or-less distinct, vertical bars, whic continue onto the fins. A row of dark spots at bases of anal and soft dor sal rays. Upper half of head dark, the lower half light. In slightl smaller specimens vertical bars are absent, the dark head coloration limit ed to lips and scattered melanophores in front of dorsal.

The specimens of *Heterostichus* examined for this paper range from Sa Francisco, California, to Ballenas Bay, Baja California. The species, how ever, has been recorded from British Columbia and from off the extreme ti of Baja California. It is common only from south of Point Conception, Cal ifornia, and north of Ballenas Bay, Baja California. There seems to be n significant variation within the species except for the specimens take from Guadalupe Island; the latter, despite the small series, must be con sidered as members of a new subspecies, *H. r. guadalupensis*. Regardless c subspecies, each of the 4 color phases is generally from a different habi tat: plain from offshore rocks below tidal range down to 26 fathoms striped from eelgrass beds in bays; barred from offshore kelp at surface and mottled from rocky, intertidal areas. These phases may interchange and any one may be found in any other locality, either in a pure form c with 2 or more color patterns combined.

This fish lives amongst the larger vegetation. It habitually lies al most motionless along the strands of kelp, usually at about a 45° angle with the head up or down. In such a position this fish is almost invisibl because its color pattern fits so well into its background.

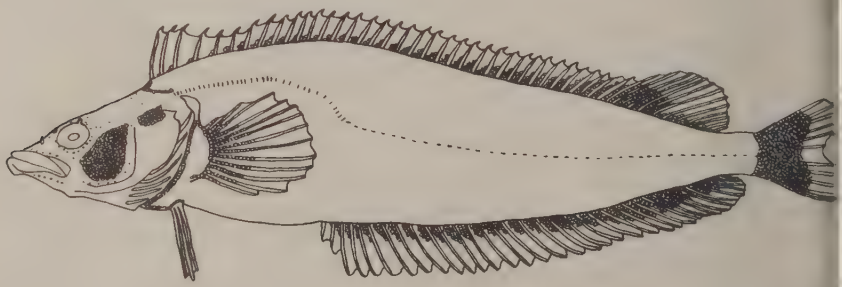


FIG. 42. *Heterostichus rostratus rostratus*. A 200-mm. specimen f SU 35159. Note scale patches on head and fins.

Heterostichus rostratus rostratus Girard
Figure 42

Heterostichus rostratus Girard, 1854, p. 143 (type locality San Diego, Ca ifornia; holotype USNM 284); 1858, p. 36.—Günther, 1860, p. 26 1861a, p. 261.—Cooper, 1868, p. 492.—Yarrow and Henshaw, 1878,

201.—Rosa Smith, 1880a.—Jordan and Gilbert, 1880c, p. 25; 1881a, p. 454.—Jordan and Jouy, 1881, p. 5.—Jordan and Gilbert, 1881b, p. 63; 1882d, p. 279; 1883b, p. 764, 962.—Rosa Smith, 1883a, p. 217; 1885a, p. 46.—Jordan, 1885a, p. 909.—C. H. Eigenmann, 1892, p. 171, 173.—Eigenmann and Eigenmann, 1892, p. 357.—Jordan and Evermann, 1896a, p. 467; 1898, p. 2351.—Jordan and McGregor, 1899, p. 284.—Starks and Morris, 1907, p. 232.—Holder, 1907, p. 587.—Holder and Jordan, 1909, p. 232, pl.—Holder, 1910, p. 1140.—Evermann and Latimer, 1910, p. 139.—Metz, 1912, p. 43, pl. 2, fig. G, textfigs. 13, 14.—Halkett, 1913, p. 35, 110; 1914, p. 365.—Starks, 1916, p. 35.—Jordan, 1919, p. 258.—C. L. Hubbs, 1920, p. 19.—Fowler, 1923, p. 79; 1924, p. 293, 300.—C. L. Hubbs, 1927, p. 363.—Jordan, Evermann and Clark, 1930, p. 458.—Schultz and DeLacy, 1936, p. 139.—Barnhart, 1936, p. 86, fig. 259.—Brock, 1938, p. 131.—Breder, 1946, p. 19, 27, 30.—Fitch and Young, 1948, p. 67.—Roedel, 1948, p. 118, fig. 89.

This subspecies is distinguished from *Heterostichus rostratus guadalupensis* under that heading.

The 258-mm. holotype (USNM 284, collected by Lt. Trowbridge from San Diego, California) and the following 116 other specimens, from 50 to 277 mm., were examined: one from the San Francisco, California, market, SU 5106; one from Monterey Bay, California, UMMZ 56337; 5 from off Santa Barbara, California; 6 from off Summerland, California, CAS 11372 and 11379; one from off Rocky Point, Santa Monica Bay, California; 3 from Portuguese Bend, California; 5 from Inspiration Point, California; 8 from Cabrillo Beach, California; 33 from off La Jolla, California; 3 from Bird Rock, San Diego, California; 16 from Mission Bay, California; 3 from off Point Loma, California, including SU 35159; 3 from San Diego Bay, California; 3 from 7 to 10 fathoms off Los Coronados, Baja California, including SU 15419; 14 from Morro Point, north of Ensenada, Baja California, SU 15420; 6 from San Quintin Bay, Baja California, SU 15275 and 15318; one from Cerros (Cedros) Island, Baja California, TNHC 853; 4 from West Benito Island, TNHC 854; one from southeast of Cerros (Cedros) Island, Baja California, NYZS 27031; and 10 from Port San Bartolomé, Baja California, SU 15410 and 15411 and NYZS 27031.

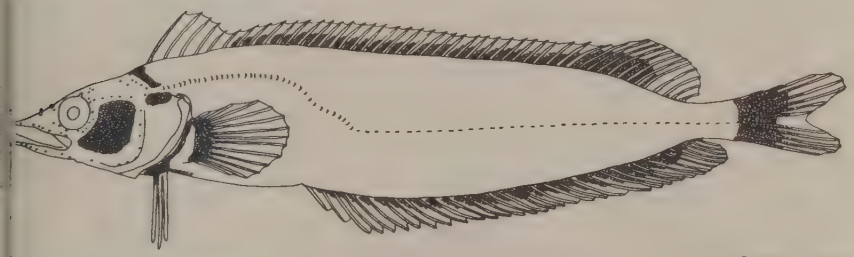


FIG. 43. *Heterostichus rostratus guadalupensis*, n. sp. A 180-mm. specimen from TNHC 599. Note scale patches on head and fins.

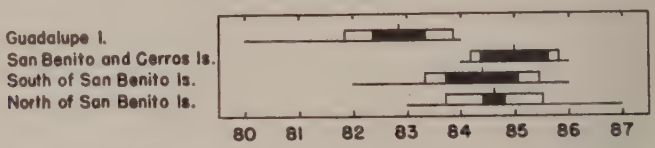
Heterostichus rostratus guadalupensis Clark Hubbs, new subspecies
Figure 43

Although only 19 specimens from Guadalupe Island have been examined, it is believed that they represent a distinct subspecies. It can be distinguished from the mainland form by the reduced number of dorsal and anal rays (Graph 50). The specimens from south of Cerros (Cedros) Island, from

Cerros (Cedros) and San Benito Islands, and from north of Cerros (Cedros Island vary among themselves in the above counts, but in no case is th variation of statistical significance. The constancy of the number of f rays counted on specimens from localities other than Guadalupe Island su ports the belief that the members of the species *Heterostichus rostratus* (that island form an endemic subspecies.

Named *guadalupensis* from its geographic locality.

The 87.5-mm. holotype (SU 16330) was dredged from 22 to 25 fathoms (January 29, 1950, by Carl L. Hubbs and party from the *Orca* from Melpomer Cove, Guadalupe Island, Baja California. The following 18 other specimen from 67 to 241 mm., from the tide pools and offshore rocks of Guadalu Island are designated as paratypes: CAS 1922 and 1923, SU 5893, and TN 419, 599, and 855.



GRAPH 50. Subspecies of *Heterostichus rostratus*. Sum of dorsal and an fin rays.

Genus GIBBONSIA Cooper

Gibbonsia Cooper, 1864, p. 109 (type species by original designation *Myxod elegans* Cooper; name proposed provisionally if generic separati proved valid).

Blakea Steindachner, 1876, p. 196 (type species by monotypy *Myxodes elega* Cooper).

Gibbonsia can be separated readily from *Myxodes* and *Heterostichus*, t other genera in the Myxodidi: from *Myxodes* by the presence of vomeri teeth; from *Heterostichus* by the shape of the caudal fin (lunate instead forked), fewer spines and rays in dorsal (XXXII to XXXVII, 4 to 10 inste of XXXV to XXXVIII, 11 to 13) and anal (I to III, 21 to 28 instead of I 31 to 35), larger scales (95 to 230 compared with 215 to 280, in a longit dinal series above lateral line), and shape of head.

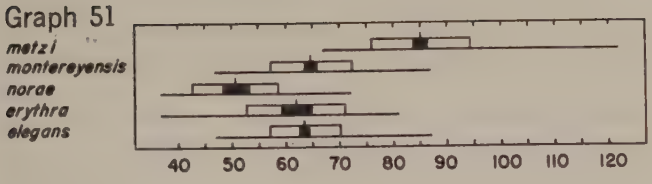
In the genus *Gibbonsia* the upper jaw typically extends to a point bel anterior half of eye. A cirrus on each anterior nostril and over ea orbit; that on anterior nostril usually entire, that on orbit variable, t never split to the base.

Conical teeth present on premaxillaries, mandibles, and vomer. Tee in jaws consist of an outer row of enlarged teeth and some smaller inn teeth. Those on vomer are of the smaller size.

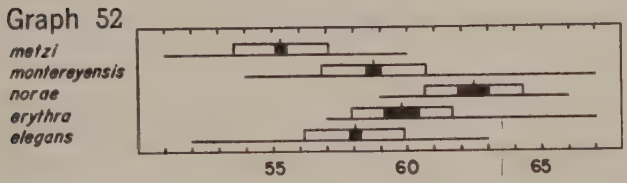
The body profile varies considerably in detail but in general is as f lows: it is convex or straight as it rises rather rapidly from snout nape, then rises more rapidly to first dorsal spine; is rather level alc spinous dorsal, only to drop gently at the last spines and dorsal soft r to the horizontal caudal peduncle. Peduncle of about average length a depth for the Clinidae. Body strongly compressed (less than half as w as deep over anus).

Dorsal usually originates at a point above posterior margin of preop cle. Spines are all sharp and stout. First spine the longest, spine len then decreases to fifth spine, which is the shortest; sixth and sever

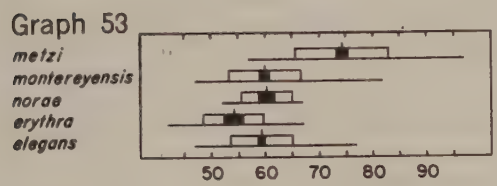
Graph 51



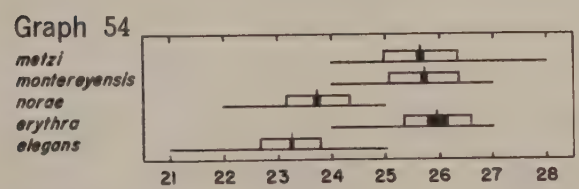
Graph 52



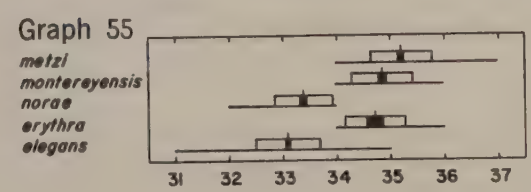
Graph 53



Graph 54



Graph 55



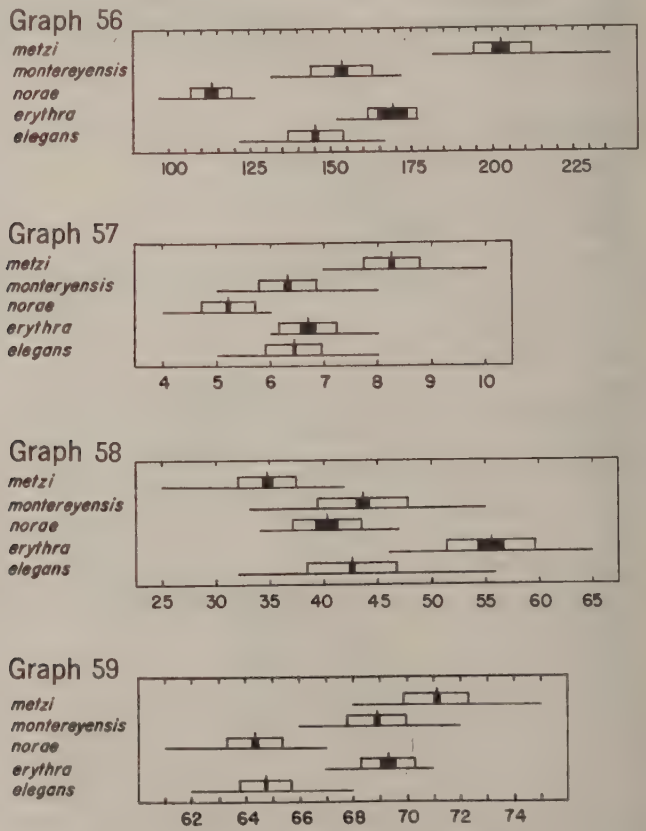
GRAPHS 51-55. Species of *Gibbonsia*. Graph 51. Second dorsal soft ray into length of dorsal soft ray base, in percents, minus 2% for each 10 mm. standard length. Graph 52. Head length into nape-to-mandible distance. percents. Graph 53. Caudal peduncle length into caudal peduncle depth, percents, minus 1% for each 10 mm. of standard length. Graph 54. Anal oft rays. Graph 55. Dorsal spines.

spines considerably longer; the next 20 spines approximately of equa height; the last 3 spines longer, but shorter than the first. First dors soft rays longer than any spines. The spines approximately equally spac except for those in anterior portion of fin. Distance between third a fourth spines usually the greatest (approximately twice average distance Tips of last rays do not extend beyond caudal base; the last ray for i entire length is attached by a membrane to caudal peduncle.

Short caudal rounded.

The 2 anal spines similar to dorsal spines. Anterior soft rays of a proximately equal length. Posterior rays slightly longer except for la 2, which are shorter. Tips of last rays do not reach beyond caudal base.

The seventh or eighth ray of the rounded to pointed pectorals the lon est. Membranes more deeply incised ventrally than dorsally. The seco ray of the short and blunt pelvics the longest, the third the shortest b is not a splint.



GRAPHS 56-59. Species of *Gibbonsia*. Graph 56. Scale rows above late line. Graph 57. Dorsal soft rays. Graph 58. Head length into first dor spine length, in percents. Graph 59. Sum of dorsal and anal fin rays.

he small, imbricate scales have radii on all their margins (Fig. 58). l ough extent of scalation varies greatly within the genus, there are al- a some scales on dorsal and pectoral fins.

ateral line extends posteriorly from upper edge of opercle in a gentle r or straight line to tips of pectoral rays, then drops gently to mid- i , along which it extends to caudal. Each scale on the anterior segment c s an external pore on the anterior portion of the scale; those on the o erior portion have a pore at each end of a tube.

he color patterns in this genus vary greatly. Individuals of one spe- i s group may have certain color patterns which never occur in other mem- e s of the genus, but other individuals of that species group may lack n e color patterns.

revious authors have recognized up to three forms of this genus, which e been included in two species. The author believes tnat this number t be increased to ten forms, included in five species. These five spe- i s can be placed in three species groups, which represent the three r viously recognized forms. These groups are: 1) *Gibbonsia metzi metzi* L. Hubbs and *Gibbonsia metzi ferventer* new subspecies; 2) *Gibbonsia ele- o s elegans* (Cooper), *Gibbonsia elegans velifera* new subspecies, *Gibbonsia l gans erroli* new subspecies, and *Gibbonsia elegans rubrior* new subspecies; r 3) *Gibbonsia montereyensis montereyensis* C. L. Hubbs, *Gibbonsia mon- e eyensis vulgaris* new subspecies, *Gibbonsia norae* new species, and *Gib- s sia erythra* new species.

The members of this genus are mostly tide-pool inhabitants. The only e eptions are *Gibbonsia elegans velifera*, which inhabits *Vallisnaria* in l bays and the *Phallospadix* in deep water off the coast; *Gibbonsia ery- t a*, which inhabits the deeper water off southern California; and *Gibbon- s a elegans rubrior*, which lives in the deeper-water *Phallospadix* off G dalupe Island, Baja California. *Gibbonsia metzi* young are occasionally f nd semipelagically immediately offshore.

The five species can be distinguished by Graphs 51 to 60 and the follow- i g key.

Key to the Species of GIBBONSIA

1a. More than 180 scales in a longitudinal series above lateral line (Grapn 56); dorsal soft rays 7 to 10 (Graph 57); dorsal soft rays equally spaced (Figs. 47, 48).....*G. metzi* (p. 120)

1b. Fewer than 180 scales in a longitudinal series above lateral line (Graph 56); dorsal soft rays 4 to 8 (Graph 57); first dorsal soft rays closer together than posterior rays (Figs. 49, 52, 53, 54, 61, 62, 63, and 64).

2a. Caudal scaled.....*G. elegans* (p. 138)

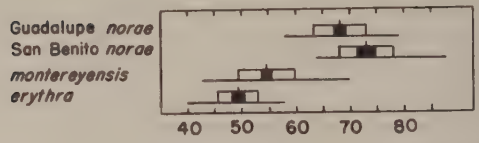
2b. Caudal naked.

3a. Posterior portion of caudal peduncle scaled; first dorsal spine long (Graph 58).....*G. erythra* (p. 135)

3b. Posterior portion of caudal peduncle naked; first dorsal spine short (Graph 58).

4a. Scale rows in a longitudinal series above lateral line fewer than 129 (Graph 56); total of dorsal and anal rays 61 to 67 (Graph 59); tenth dorsal spine length 59% to 88% of first dorsal spine length (Graph 60).....*G. norae* (p. 126)

4b. Scale rows in a longitudinal series above lateral line more than 130 (Graph 56); total of dorsal and anal rays 66 to 72 (Graph 59); tenth dorsal spine length 42% to 69% of first dorsal spine length (Graph 60).....*G. montereyensis* (p. 130)



GRAPH 60. *Gibbonsia montereyensis*, species group. First dorsal spine length into tenth dorsal spine length, in percents.

Correlation of Vertebral Numbers with Fin Rays in *Gibbonsia*

The number of vertebrae in this genus shows a very close correlati with the number of dorsal and anal rays. This condition is not surprisin considering the fact that each dorsal and anal basal is articulated wi its own neural or haemal spine. However, the reverse is not true, as t posterior vertebrae are not necessarily articulated with any dorsal or an basal, nor are the trunk vertebrae articulated with any anal rays; mor over, the first 3 dorsal spines are articulated with the occipital regi of the skull.

The correlation between the vertebral number and dorsal and anal f rays is not only intraspecific but also interspecific (Table 5). The co relation is not true intergenerically as the counts for *Heterostichus ro tratus rostratus* and *Paraclinus integripinnis integripinnis* do not agr with a regression drawn up from the counts for the species of *Gibbonsia*.

TABLE 5
Correlation of vertebral numbers with fin rays

Total of dorsal and anal rays	Vertebral total 47	48	49	50	51	52	Y intercept	slo
62		1					-25.8	1.88
63		4						
64	1	29	3					
65		31	14					
66		15	15					
67			1					
68				4	1			
69					3			
70					18	1		
71					9	1		
72					6	3		
73						2		

Gibbonsia metzi C. L. Hubbs
For synonomy see subspecies

As stated by C. L. Hubbs (1927), the name applied to this species been the source of considerable confusion. The species was first dist guished from *G. elegans* by Jordan and Evermann (1898), being reduced, h ever, to subspecific status by the same writers (p. 2869). The authors u the name *Gibbonsia evides* previously proposed by Jordan and Gilbert (18 as a substitute for *Myxodes (Gibbonsia) elegans* of Cooper (1864), not C *nus elegans* Cuvier and Valenciennes (1836). Thus the name *evides* is an conditional synonym of *elegans* and cannot be applied to this species.

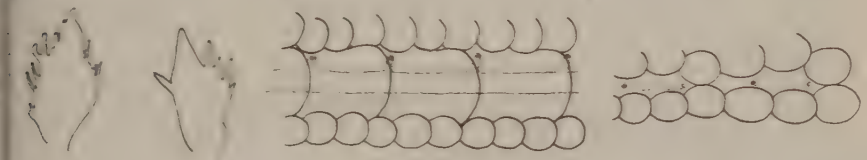
Vertebrae 18 to 19 (18) + 32 to 34 (33) = 50 to 52 (51 to 52); dor XXXIV to XXXVII (XXXV to XXXVI), 7 to 10 (8 to 9); anal II, 24 to 28 (2

total of dorsal and anal rays 68 to 75 (70 to 73); caudal 10 to 11 1); pectorals 11 to 13 (12); pelvics I, 3; branchiostegal rays 5 to 6 5 single lateral line pores 27 to 37 (30 to 35); double pores 33 to 39 3 to 38); total lateral line pores 64 to 71 (66 to 70); scale rows above eral line 180 to 235 (185 to 220); gill rakers 3 + 8 = 11.

Head and snout bluntly pointed. The equal jaws have slightly projecting is, about equal to suborbital distance. Upper jaw extends almost to a int below middle of eye. The round eye about one-third of eye diameter ow dorsal profile. Interorbital evenly convex. Posterior margin of op- rle smooth. Smooth posterior margin of preopercle located midway in torbital bony length. Cirri over anterior nostrils and orbits, but none nape; those on nostrils entire, but the short ones over eyes finely unched at edges (Fig. 44).

The gently convex profile rises from snout to nape, then it rises ab- tly to first spine, where it becomes concave and rises slightly to fourth ne, behind which it is again convex to sixth spine. Profile then runs el to thirtieth spine, where it drops gently to first soft ray, then e rapidly to caudal peduncle, on which it runs level. Peduncle short d deep. Body and head compressed to about one-half depth at belly.

Figure 44 Figure 45 Figure 46



FIGS. 44-46. *Gibbonsia metzi*. Fig. 44. Orbital cirri. Fig. 45. Anter- r lateral line scales. Fig. 46. Posterior lateral line scales.

First dorsal spine inserted slightly before posterior margin of preoper- e. Soft rays only slightly longer than first spine. First 5 rays of out equal length, the others progressively shorter. Tips of last rays do t reach caudal base. Each spine bears a flag. Rays approximately equally aced (Figs. 47 and 48).

First anal spine goes 1.2 and from 1.8 to 2.2 times into second spine d first soft ray respectively. Soft rays remain even as far as twentieth, ere become progressively longer to the last 2, which are much shorter. ips of last rays do not extend so far on caudal peduncle as do dorsal ays. Last ray not attached by a membrane to caudal peduncle. Membranes ncised about one-half.

The seventh ray of the short and rounded pectorals the longest. Rays hicker and more fleshy below. The pelvic rays are fleshy. Membranes in- ised about one-fourth.

Small, embedded scales completely cover the body behind a line which uns from first spine to upper margin of opercle, then along gill membranes except for naked posterior pectoral base and area immediately between pel- ic fins) to the isthmus. Head naked except for an occasional scale above opercle. Scale patches, present on membranes in front of each dorsal spine ehind the third, increase in size until they almost reach fin margin at osterior end of dorsal spines. No change in size of scale paton at begin- ing of the dorsal soft rays, but a sudden decrease in number of scales round sixth soft ray, behind which number may or may not increase. Caudal

scaled at base. Each anal ray after seventh soft ray preceded by a patc of scales similar to those between dorsal spines. Anterior side of pec- toral fin has scales covering bases of rays. Posterior side and pelvic naked. The scales have radii on all their margins, as in *Gibbonsia elegan* (Fig. 58).

Lateral line runs straight back from upper margin of opercle for abou 20 scales, then drops gently to midline for about 10 more scales, the straight to caudal base. The scales on the anterior segment each have on external pore, which is on a branch canal either above or below main cana (Fig. 45). The posterior scales have a pore at each end of a tube (Fig. 46). Lateral line canals on head typical, each has a single or double ro of minute pores.

Ground color of body usually red, although it may be green, brown, o yellow. If in the non-mottled phase, there is usually little variegation Some dark spots may occur in a longitudinal series above midline of body and traces of 4 stripes radiate from eye. A transparent "window" alway present on membranes between third and fourth dorsal spines and some of th last dorsal soft rays. Also a light and dark vertical stripe may occur a base of caudal fin. If mottled, above is true, and in addition to the 1 vertical, wavy, dark stripes on body, a series of light blotches extend posteriorly from middle base of pectoral fin. Twelve double, dark, verti cal bars occur on dorsal and 6 on anal. Caudal fin mottled and has 2 pro nounced light spots one-half to one-third of way out on its dorsal and ver tral margins. Pectorals have 7 vertical, dark bars. Three bars on pelvics including one at base.

This species ranges from near the mouth of Hondo Canyon, 175 miles sou of Ensenada, Baja California, to the Oregon-California border and is als present in southern British Columbia. It is fairly rare in the tide poo on the coast of southern California but rather common in that habitat bo to the north, in northern California, and to the south in Baja Californi where C. L. Hubbs (1948) found the water temperature to be colder than southern California. Since the specimens taken in southern California a from the outer edge of the tidal zone, it appears that this species is inhabitant of colder water and is driven to deeper water by the warm te peratures of the ocean off southern California.

Gibbonsia metzi is usually found in and about the larger vegetation the outer edge of tidal reefs. The young are pelagic and probably are bo about mid-March. Young nearing transformation have been taken in ear April at Pacific Grove, California. A large series of specimens taken December, 1945, from Punta Clara near Santo Tomas, Baja California, w measured. At least 2 definite size classes are apparent (Table 6). Tho between 40 mm. and 80 mm. are undoubtedly young of the year, those arou 100 mm. are yearlings. There is an added complication in that the femal tend to be larger than the males (Table 6).

TABLE 6

Size distribution of a collection of *Gibbonsia metzi ferventer* from Pun Clara, Baja California

	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110-119	120-129	130-139	140-149	150-159	160-169	170-179
Total	3	33	35	7	2	2	7	7	4	5	3	2	3	
Males					2	1	3	4	3	1	2	1		
Females						1	4	3	1	4	1	1	3	

Two geographic subspecies are recognized. The point of separation between Point Conception and Point Arguello. No intergrades have been se specimens from each of the above localities do not differ from their r spective subspecies sufficiently to appear intermediate.

Gibbonsia metzi metzi C. L. Hubbs
Figure 47

lakea elegans Steindachner, 1876, p. 197 (in part).
inus (Gibbonsia) evides Jordan and Gilbert, 1883b, p. 763 (in part; name substituted for *Myxodes elegans* Cooper).—Jordan, 1885a, p. 909 (in part).
inus evides C.H. Eigenmann, 1890, p. 35 (in part).—Eigenmann and Eigenmann, 1892, p. 357 (in part).—Jordan and Evermann, 1896a, p. 467 (in part); 1898, p. 2352.—Starks and Morris, 1907, p. 235 (in part).—Metz, 1912, p, 47 (in part).
ibbonsia elegans evides Jordan and Evermann, 1898, p. 2869.
ibbonsia elegans Greeley, 1899, p. 20 (in part).
ibbonsia metzi C. L. Hubbs, 1927, p. 350 (in part; type locality Pacific Grove, California, holotype UMMZ 55004).—Jordan, Evermann and Clark, 1930, p. 458 (in part).—Barnhart, 1936, p. 86 (in part).—Schultz and DeLacy, 1936, p. 138.—Clemens and Wilby, 1946, p. 173 (in part), fig. 108.—C. L. Hubbs, 1948, p. 461 (in part).

This subspecies is differentiated from *G. m. ferventer* in the account for the latter subspecies.

The 144-mm. holotype (UMMZ 55004) was collected by Carl L. Hubbs in May or June, 1913, from Pacific Grove, California. The following 66 paratypes,

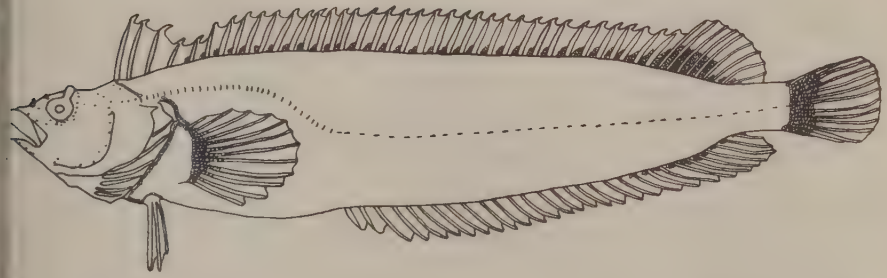
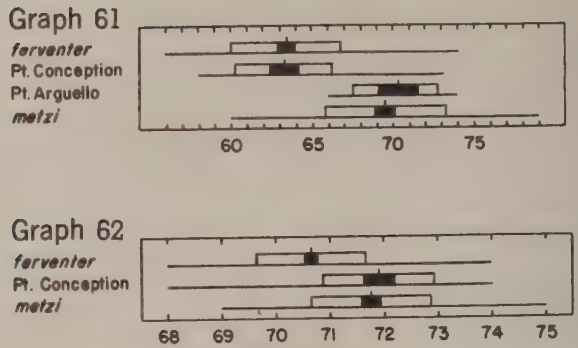


Fig. 47. *Gibbonsia metzi metzi*. A 211-mm. specimen from SU 15079. Note scale patches on nape and fins.

from 50 to 194 mm., were examined: 45 from Crescent City, California, UMMZ 63874, 63893, 63894, 63896, 63897, 63901, and 64320; and 21 from near Point Arguello, California, UMMZ 64323 and 64324. The following 121 other specimens, from 50 to 211 mm., were also examined: one from Crescent City, California, SU 35426; one from a cove northwest of Bodega Head, Sonoma County, California, SU 40332; one from Tomales Bay, California, CAS 18244; one from Drakes Bay, California, CAS 7513; one from Duxbury Reef, Marin County, California, SU 40331; 4 from San Francisco Bay, California, CAS 7565, and UMMZ 63877, 63891, and 92273; one from Halfmoon Bay, California, SU 24650; one from Pillar Point, San Mateo County, California, SU 35110; 15 from Elknorn Slough, California, SU 15488 and 15489; 13 from Monterey, California, SU 4128; 37 from Pacific Grove, California, SU 9896, 15478, and 24674; 5 from Carmel, California, SU 15485; 17 from Cayucas Point, San Luis Obispo County, California UMMZ 141184; and 23 from Point Buchon, California, SU 15064 and 15079.



GRAPHS 61-62. Subspecies of *Gibbonsia metzi*. Graph 61. Head length into sum of caudal peduncle length and first anal soft ray length, in percents. Graph 62. Sum of dorsal and anal fin rays.

Gibbonsia metzi ferventer Clark Hubbs, new subspecies
Figure 48

Clinus (Gibbonsia) evides Jordan and Gilbert, 1883b, p. 763 (in part; name substituted for *Myxodes elegans* Cooper).—Jordan, 1885a, p. 909 (in part).

Clinus evides Rosa Smith, 1883b, p. 235 (in part); 1885a, p. 45 (in part).—C. H. Eigenmann, 1890, p. 35 (in part); 1892, p. 171, 173 (in part).—Eigenmann and Eigenmann, 1892, p. 356 (in part).—Starks and Morris, 1907, p. 235 (in part).—Metz, 1912, p. 47 (in part), pl. 5, figs. 18-19.

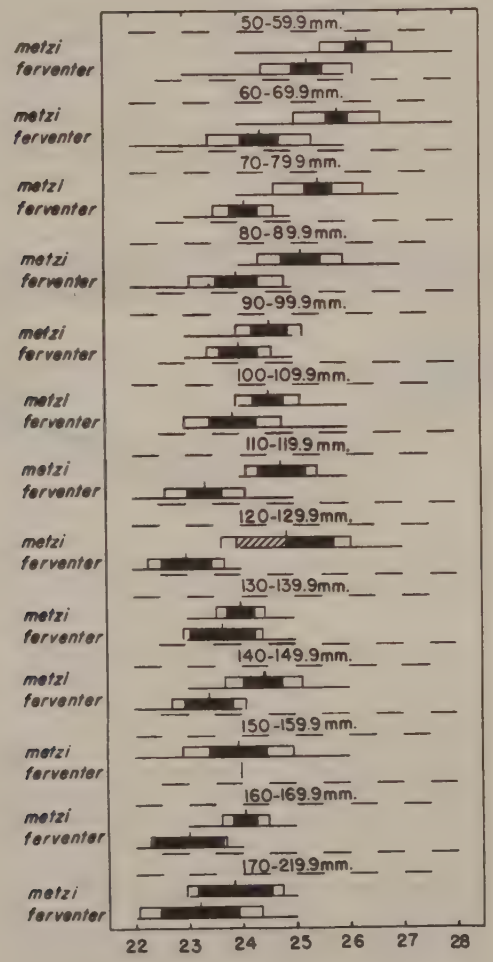
Gibbonsia elegans Jordan and Evermann, 1896a, p. 467 (in part).—Greeley, 1899, p. 20 (in part).—Evermann and Latimer, 1910, p. 139 (in part).—Fowler, 1924, p. 293, 300 (in part).

Gibbonsia metzi C. L. Hubbs, 1927, p. 360 (in part).—Jordan, Evermann and Clark, 1930, p. 458 (in part).—Barnhart, 1936, p. 86 (in part), fig. 258.—Clemens and Wilby, 1946, p. 173 (in part).—C. L. Hubbs, 1948, p. 461 (in part).

This subspecies has a slightly shorter caudal peduncle and first anal soft ray than *G. m. metzi*. When these 2 measurements are added and their proportion to the standard length plotted, their standard deviations scarcely overlap (Graph 61). In these calculations the specimens from both Point Arguello and Point Conception are on the average slightly, but not statistically, more extreme than the subspecies to which they belong. Although the differences between the two subspecies are barely of subspecific value, these differences, together with the sudden change of the proportional lengths between the specimens taken at Point Conception and Point Arguello (Graph 61), are believed to be enough to merit subspecific distinction. They are not, however, believed to be of specific rank. The two subspecies can be further distinguished by the statistically smaller total of dorsal and anal rays in *G. m. ferventer* as compared with the northern subspecies (Graph 62). In this table the specimens from Point Conception agree with

m. metzi rather than with *G. m. ferventer*. The southern subspecies also s a proportionally longer head than *G. m. metzi*. Of the 13 size groups asured the difference is of great statistical significance in 8, of doubt- l statistical significance in 2, and of no statistical significance in (Graph 63). In all of the last 3 size groups, too few specimens (17) ere examined for fine statistical treatment.

Named *ferventer* (Latin, hotter or warmer) because of the warmer water abitat compared to that of *G. m. metzi*.



GRAPH 63. Subspecies of *Gibbonsia metzi*. Standard length into head length, in percents, by 10-mm. size groups.

The 89.5-mm. holotype (SU 15396) was collected on December 18, 1945, by Carl L. Hubbs and party from a tide pool in Santo Tomas Bay, Baja California. The following 334 specimens, from 50 to 184 mm., are designated as paratypes: one from Rincon Point, California, SBSC 100; 10 from Santa Barbara, California, SBSC 110 and TNHC 453; 57 from Fraser Point, Santa Cruz Island, California, SU 15403, 15404, and 15405; 54 from Portuguese Bend, Los Angeles County, California; one from Bayview, Anaheim Creek, California, UMMZ 86062; one from Laguna Beach, California, SU 35137; 21 from San Clemente Island, California, SU 15400 and 15402; 7 from Bird Rock, San Diego, California, SU 15395, 15397, and 15399 and CAS 20493; 29 from Point Loma, San Diego, California, SU 15401; one from halfway between Ensenada and Tijuana, Baja California, SU 15394; 118 from Santo Tomas Bay, Baja California, SU 15390; 16 from Cape San Quintin, Baja California, SU 15327; two from Entrada Point, San Quintin Bay, Baja California, SU 15306; and 12 from 2 miles south of the mouth of Rio Socorro, Baja California. The following 50 specimens, from 50 to 159 mm., from Point Conception, California, are not designated as paratypes since their dorsal and anal counts agree with those of *G. m. metzi*: SBSC 82, 83, 85, 85a, 86, 87, and 88.

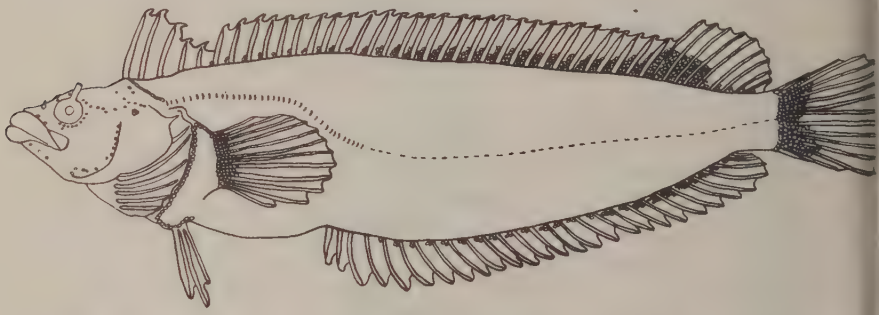


FIG. 48. *Gibbonsia metzi ferventer*, n. subsp. A 160-mm. specimen from SU 15402. Note scale patches on head and fins.

Gibbonsia norae Clark Hubbs, new species
Figure 49

Dorsal XXXIII to XXXV, 4 to 6; anal II, 22 to 25; total dorsal and ana rays 61 to 65; caudal 11, pectorals 11 to 13 (12); pelvics I, 0 or I, (I, 3); branchiostegal rays 5 to 6 (6); single lateral line pores 28 to 33 double lateral line pores 20 to 31; total lateral line pores 50 to 60; longitudinal scale rows above lateral line 95 to 130; gill rakers 3 + 8 to 10

Snout blunt. The rather thick lips two-thirds suborbital in width. Jaws equal, or lower slightly projecting. Maxillary, not expanded posteriorly, reaches to anterior one-sixth of eye in females, to anterior one-third in males. Eye does not enter dorsal profile. Narrow interorbita convex. Posterior edge of opercle smooth. Rounded posterior edge of pre opercle located just behind middle of postorbital bony length. A simpl cirrus over each anterior nostril; a single but deeply fimbriate cirru over each eye (Fig. 50).

The profile is concave as it rises gently to eye, becoming convex aroun eye and again concave to nape; it then rises abruptly to first spine, fro which it rises gently to fifth, beyond which it extends level to last spin

ales, decreases slightly in females. It drops rapidly along dorsal rays to the level caudal peduncle. Peduncle long, rather narrow. and body compressed to about one-half depth over first anal spine. irst dorsal spine inserted just in front of posterior margin of preop- e. Dorsal soft rays higher than anterior crest of spinous dorsal; the nd soft ray the longest, the following ones successively shorter. The anterior soft rays set about half as far apart as posterior ones (Fig. Spines all bear noticeable flags. All membranes slightly incised ept the one between fifth and sixth spines, which is incised one-third. First anal spine contained 1.1 and 1.7 to 2.0 times in second spine and st soft ray respectively. Soft rays remain about equal in length up to 8, which become longer up to the next-to-last, which is longest. Tips longest rays extend to base of caudal fin, the last ray not attached to dal peduncle by a membrane. Membranes incised from two-fifths to one- f.

The eighth ray of the rounded pectorals the longest. Rays thickened ow. Second ray of the short pelvics the longest, the third the shortest, first soft ray stout. Membrane between first and second rays incised ularly; that between the second and third scarcely, or not, incised.

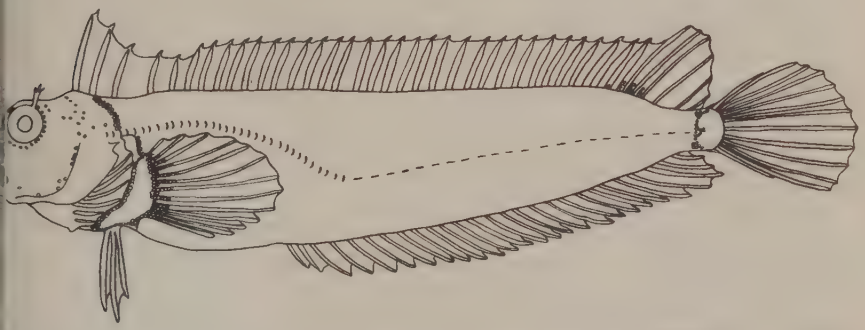


FIG. 49. *Gibbonsia norae*, n. sp. A 78-mm. male from TNHC 431. Note ale patches on nape and fins.

Entire head naked. Body covered with small, partly embedded, nonimbri- te scales except on posterior pectoral base and the seminaked caudal ped- cle. Central posterior portion of caudal peduncle naked. Upper and wer sides of naked patch encroached upon by the body scales, and crossed lateral line scales. Almost no scales on membranes of dorsal spines, e or two on extreme basal portion of posterior spines only. Membranes etween first 3 dorsal soft rays have from one to 3 small, embedded scales; hose behind usually have none. No scales on caudal, anal, or pelvics. nterior face of pectorals scaled for about one-fourth its length. The cales have radii on all their margins, as in *G. elegans* (Fig. 58).

Lateral line extends posteriorly from opercle in either a straight line r a gentle arc for about 20 scales and then for about 10 scales angles oward midline, on which it extends to caudal base. The scales on the an- erior segment always bear pores above the canal and occasionally have an dded pore below, as in *G. erythra* (Fig. 56). Those on the posterior seg- ent consist of a series of disconnected tubes with a pore at each end, as n *G. elegans* (Fig. 60). Canals on the head typical of the Clininae.

The color pattern in this species is as variable as that in the other iembers of the family. Ground color varies from brown, through greenish,

to coralline; color pattern varies from plain to barred to striped.

Mature males chiefly plain, and darker than females, with traces of bars, which may be more distinct anteriorly. Posterior to first 2 only traces are seen. Sides finely speckled with darker; lower sides not noticeably lighter. Dorsal fin uniformly dark except for light flags and 2 "windows" between last soft rays. Caudal light, mottled with darkish. Anal dark, with light-tipped rays. Pectorals light, with dark mottlings on rays arranged to form irregular bars; usually a dark spot on base of lowest ray. The pelvics dark with light tips. Head dark, becoming lighter below; a doubled, dark streak extending posteroventrally from eye.

The lighter specimens are young or females. Usually 7 more-or-less pronounced bars, usually wider along dorsal base than on sides, not extending to belly. First bar has a dark spot just above pectoral fin. Dark specks scattered across the light interspaces. Dorsal fin light, with dark speckling; the flags very light; a "window" on membrane between last two soft rays. Anal colored like dorsal but has no "window." Caudal, pectorals and pelvics light, with dark spots on rays. Head light, with dark markings; 3 doubled dark spokes from eye may be present, extending posteroventral, posterior, and posterodorsal from eye. Orbital cirri usually dark.

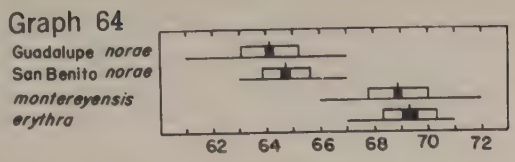
The striped phase has bars interrupted by 3 light horizontal stripes; the first runs from eye above opercle, then straight to caudal peduncle; the second extends posteriorly from pectoral fin just below midline; the third runs along anal base. Remaining color pattern like that of dark phase.

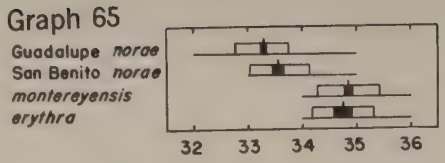
This species is apparently restricted to the tide pool zone on Guadalupe Island and the San Benito Islands, Mexico, and the two populations differ somewhat (see below). The fishes seem to prefer areas of deep crevices and coralline algae to heavy eelgrass beds. The habitat is similar to that of its near relative, *G. montereyensis*, and its ecological relation to *G. elegans erroli* on Guadalupe Island is similar to that between *G. montereyensis* and *G. e. elegans* where the range of the latter two species overlaps.

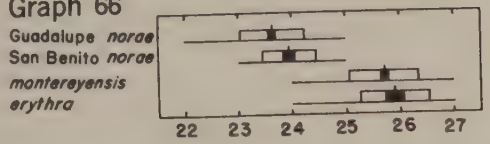
As no specimens of the species group *montereyensis* have been examined from the area between the San Benito Islands and Santo Tomas Bay, it is not possible to determine beyond dispute whether *norae* is of specific or subspecific rank. The present evidence, however, strongly indicates that these isolated populations are actually specifically distinct from *montereyensis*. In each species the populations nearest the other geographically do not show a tendency to intergrade. There is no overlap in number of scale rows in a longitudinal series above lateral line (Graph 56). Moreover, the total number of dorsal and anal rays scarcely overlap (Graph 64). Likewise, typical *montereyensis* never has the chunky appearance immediately behind the head so typical of *norae*. The latter is very easily distinguished from *erythra*, not only by the number of dorsal and anal rays but also by the naked spot on the caudal peduncle.

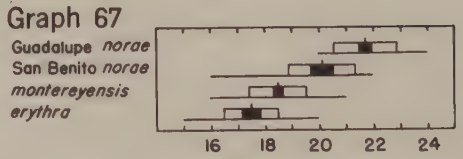
The two populations of *norae* are by no means identical. The Guadalupe specimens have a statistically greater number of dorsal spines (Graph 65), anal soft rays (Graph 66), and total number of dorsal and anal rays (Graph 64) than the San Benito specimens. The latter have a statistically shorter distance from eye to preopercle (in line of greatest postorbital bone length) than do the Guadalupe specimens (Graph 67). Although these tables suggest that the San Benito population might represent intergrades, the proportions of tenth dorsal spine length to first dorsal spine length (Graph 60) and body depth to standard length (Graph 68) are extreme in the San Benito specimens. This equal distribution (actually 2 to 2) of the extreme characters between the two populations does not support an hypothesis that either population is intermediate.

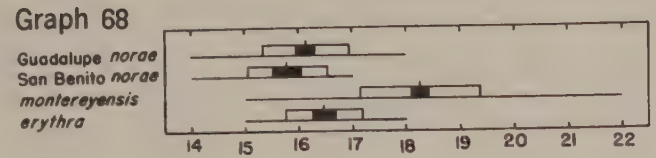
Although the differences between the two populations are not believed to be sufficient for subspecific rank, the San Benito specimens are not designated as paratypes.











GRAPHS 64-68. *Gibbonsia montereyensis*, species group. Graph 64. Sum of dorsal and anal fin rays. Graph 65. Dorsal spines. Graph 66. Anal soft rays. Graph 67. Head length into eye-to-preopercle distance, in line of greatest bony postorbital length, in percents, minus 0.5% for each 10 mm. of standard length. Graph 68. Standard length into body depth, in percents, minus 0.5% for each 10 mm. of standard length.

A single larval specimen taken on December 7, 1946, from Guadalupe Island shows that this species spawns in the fall. The size of other specimens taken in the same collection indicates that they were spring-spawned young. If this is true, *G. norae* spawns at least twice a year.

Named *norae* for Mrs. Nora Eddington Flynn.

The 53-mm. holotype (SU 16249) was collected by Carl L. Hubbs and party on December 8, 1946, from Guadalupe Island, Mexico. The following 27 specimens, from 50 to 78 mm., from the type locality are designated as paratypes: SU 16250, 16252, 16253, and 16254, NYZS 27005, USNM 152000, CNHM 51443, and TNHC 416 and 431. The following 120 specimens, from 50 to 6 mm., were collected from a reef at the east end of the north shore of West Benito Island, Baja California: TNHC 406 and NYZS.

Figure 50 Figure 51

FIGS. 50-51. Fig. 50. *Gibbonsia norae*, n. sp. Orbital cirrus. Fig. 51. *Gibbonsia montereyensis*. Orbital cirri.

Gibbonsia montereyensis C. L. Hubbs
For synonymy see subspecies

This form was described by C. L. Hubbs (1927) as a subspecies of *Gibbonsia elegans* (Cooper). The present study has shown that this so-called subspecies is actually a full species. The specimens originally called intergrades have been re-examined and can be placed easily in one or the other species. Specimens of the two species have been taken together at several localities without any sign of intergradation. Additional nonoverlapping characters, not given in the original description, further serve to strengthen the hypothesis that *G. montereyensis* is distinct from *G. elegans*.

Vertebrae 16 to 18 + 33 to 34 = 49 to 51; dorsal XXXIV to XXXVI, 5 to anal II, 24 to 27; total of dorsal and anal rays 66 to 72 (67 to 71); caudal 10 to 12 (11); pectorals 11 to 13 (12); pelvics I, 3; branchiostegal rays 6; lateral line scales of the anterior type 30 to 38, of the posterior type 29 to 36; total lateral line scales 61 to 70; scale rows in a longitudinal series above lateral line 130 to 175; gill rakers 3 to 4 + 9 to 12.

Head and snout sharply pointed. Jaws equal. The terminal lips contained from 1.0 to 1.2 times in suborbital. Maxillary extends to below point halfway between pupil and anterior rim of orbit. Round eye does not enter dorsal profile. Narrow interorbital gently concave. Opercle does not bear a spine on its posterior margin. Posterior margin of rounded preopercle midway along postorbital bony length. A simple cirrus over each anterior nostril, a deeply incised one over each orbit (Fig. 51).

The profile rises evenly from snout to first dorsal spine, then straight or slightly concave and increases in height to fourth spine, where it becomes convex and rises to base of sixth spine. It then extends level to about thirty-second spine, from there is straight or convex and drops to caudal peduncle, on which it is horizontal. Peduncle long and narrow. Head slightly compressed, body strongly compressed.

rst dorsal spine originates considerably in front of posterior margin
opercle. First 3 or 4 soft rays much longer than first spine. Fin
ne drops almost straight from fourth soft ray to caudal peduncle.
of last rays do not extend to caudal base. Dorsal soft rays evenly
d except fourth to sixth or fifth to seventh, which are twice as far
as the others (Figs. 52 and 53). Incisions between rays slight ex-
those between fifth and seventh spines, which are incised one-half.
s all bear prominent flags.

rst anal spine contained 1.2 and 2.0 times in second spine and first
ray respectively. Fin depth increases gradually for about 18 rays
nen rapidly for 5 rays; last 2 rays noticeably shorter. Last ray
down by a membrane to caudal peduncle for one-fifth its length. Rays
ed one-third to one-half.

e eighth ray of the rounded pectorals is the longest; upper rays are
y, the lower rays very fleshy. Second ray of fleshy pelvics the long-
the very stout first ray longer than the third. Membrane between
2 rays incised about one-third, that between last 2 about one-seventh.
e small scales are slightly imbricate. A naked spot on caudal pedun-
encroached upon by scales which extend along lateral line and dorsal
entral parts of peduncle. Rest of body scaled except surfaces between
c fins, under gill membranes, posterior base of pectoral fin, the ad-
t portion of body, and nape. Head naked. Usually no scales on pel-
caudal, and anal. Dorsal has a small patch of scales on membranes
se of last 12 spines and first 4 soft rays. Pectorals thickly scaled
one-sixth their length, some additional scales more distal on central
The scales have radii on all margins (Fig. 58).

teral line extends posteriorly from opercle for about 20 scales in a
e arc or straight line, then drops gently for about 13 scales to mid-
on which it runs to caudal fin. Scales on the anterior portion al-
consist of an external pore above main canal, and usually one below as
as shown in *G. erythra* (Fig. 56). Those on the posterior segment con-
of a pore at each end of a tube. These tubes are not connected (see
legans, Fig. 60).

he life colors exhibited by this species are variable. The several
r phases (coralline, green, dark, and silver-barred) combine with each
r to a variable extent. The most common phase, coralline, has a coral-
le ground color with about 8 white-lined blackish bars, often inter-
ed. Frequently one dark ocellus, occasionally more, above lateral line
behind pectorals. Many silver-white spots behind pectorals. Belly
e with coral blotches. Dorsal deep purple with numerous "windows."
al rays covered with spots arranged so as to give the fin a barred ap-
ance. Caudal membranes colorless. Anal has dark purple, parallel,
le bars with intervening purplish-cream bars. Pelvic cream with 3 dark
le bars. Pectoral rays are barred with dark purple and yellow; pec-
l membranes colorless. Head usually has 4 spokes extending from eye;
ral band down middle of snout; tips of superorbital cirri coral; under-
s of head white, mottled with purple brown; many silver spots on skin
ring mandible and dentary.

The ground color of the green phase is green, and plain, with a few
kings. A dark purple blotch behind pectorals. A dark line along the
line. Belly light green. Fins all green except caudal and posterior
s of dorsal and anal, which are yellowish green, and pectoral, which has
kish tips. Head dark above and lighter below, with a doubled, dark
eak from eye to posterior end of mandible.

The ground color of the dark phase is either red or brown. An ocellus
ve the pectoral. Lower sides lighter than upper. Dorsal a solid color
n "windows" behind third spine and last soft rays in some specimens. A
nt bar across middle of caudal. Anal dark, with faint barring. Pelvics
k, with pinkish tips. Pectorals barred with lavender.

Any of the above phases may be combined with a silver bar from the pe toral back as far as caudal. This condition commonest in young specimens These color patterns may be present as described above or in any comb ation, including all four.

The species has been reported from British Columbia and the coasts California, north of Point Conception. It is also present on many of t Channel Islands off southern California, Los Coronados Islands, and San Tomas Bay, Baja California, and probably is represented just below the l tide line along the mainland by stragglers, such as the one taken at De canso Bay, Baja California. In many of the collections this species taken in conjunction with *Gibbonsia elegans* (Cooper). None of the spe mens examined are thought to be intergrades between the two species.

There is considerable morphological variation among the populations this species. The most pronounced and constant variation is between t populations from the most exposed portions of the coast (Monterey Penins and Point Buchon, California) and those from the less exposed localiti The differences are so great that it is thought the populations should included in separate subspecies. Since the holotype of the species is f Pacific Grove on the Monterey Peninsula, the name *montereyensis* must be tained for the populations from the exposed localities. The specimens f the nonexposed localities are called *Gibbonsia montereyensis vulgaris*.

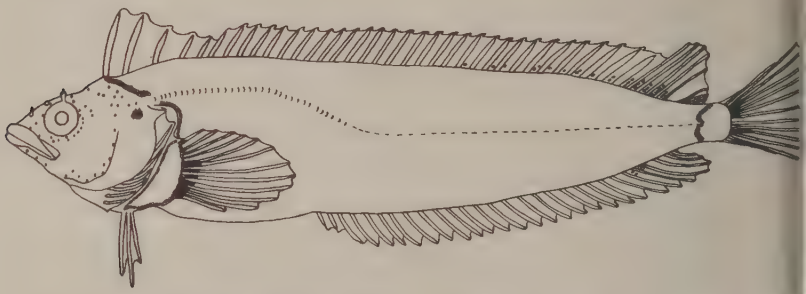


FIG. 52. *Gibbonsia montereyensis montereyensis*. An 89-mm. spec from TNHC 444. Note scale patches on head and fins.

The characters used to separate *montereyensis* into two subspecies to be correlated with ecologic factors. The two localities from whic *m. montereyensis* have been taken are separated by about 80 miles of c line along which *G. m. vulgaris* is found. Moreover, the latter subspe has been collected commonly both to the north of the Monterey Peninsul to the south of Point Buchon. Despite the interrupted geographic distr tion of the two subspecies, each is a morphologic unit when compared the other. None of the isolated units of either subspecies is dist enough morphologically from the other units of the same subspecies t proach subspecific separation. The only apparent similarity betwee localities where the respective subspecies are taken is in the amou exposure to wave action.

The binomial (or trinomial) system of classification is not adapted species such as this. It is obvious that there can be little gene flo tween the two populations of *G. m. montereyensis* without passing thro population of *G. m. vulgaris*. Therefore the two populations of the species from the exposed coast are, from this viewpoint, more closel lated to *G. m. vulgaris* than to each other. Apparently, however, th

.tions have been derived recently from a single parent stock and have
d in a parallel manner to remain almost identical, although separated
miles of coast line inhabited by another subspecies. The populations
m. vulgaris have likewise evolved from the same parent stock, but in
ferent direction. The evolution of these isolated populations has
parallel and has resulted in several morphologically similar popula-
which are separated geographically from each other. Suitable habi-
in the intervening area are occupied by the other subspecies of the
species.

Gibbonsia montereyensis montereyensis C. L. Hubbs
Figure 52

nsia elegans Cooper, 1868, p. 492 (in part).—Jordan and Gilbert, 1881a, p. 454 (in part); 1881b, p. 63 (in part).—Jordan and Jouy, 1881, p. 4 (in part).—Greeley, 1899, p. 20 (in part).—Starks and Morris, 1907, p. 232 (in part).—Metz, 1912, p. 45 (in part).
s (Gibbonsia) evides Jordan, 1885a, p. 909 (in part).
s evides C. H. Eigenmann, 1890, p. 35 (in part).—Eigenmann and Eigenmann, 1892, p. 357 (in part).
nsia evides Jordan and Evermann, 1896a, p. 467 (in part).—Starks and Morris, 1907, p. 235 (in part).
nsia elegans montereyensis C. L. Hubbs, 1927, p. 354 (in part; type locality Pacific Grove, California; holotype UMMZ 55003).—Jordan, Evermann and Clark, 1930, p. 468.
nsia montereyensis C. L. Hubbs, 1948, p. 461 (in part).

his subspecies is distinguished from *G. m. vulgaris* under that heading.
e specimens, as mentioned above, were all taken from the 2 portions of
coast line most subjected to heavy wave action, the Monterey Peninsula
Point Buchon.
e 82-mm. holotype (UMMZ 55003, collected by Carl L. Hubbs at Pacific
, California, in May or June, 1915) and the following 116 other speci-
, from 50 to 107 mm., were examined: 9 from Pacific Grove, California,
5147 and 24679; 54 from Carmel, California, USNM 152006, TNHC 444, and
142401; and 53 from 2 miles north of Point Buchon, California, SU
9 and 15085.

Gibbonsia montereyensis vulgaris Clark Hubbs, new subspecies
Figure 53

onsia elegans Cooper, 1868, p. 492 (in part).—Jordan and Gilbert, 1881b, p. 63 (in part).—Greeley, 1899, p. 20 (in part).—Metz, 1912, p. 45 (in part).
us (Gibbonsia) evides Jordan, 1885a, p. 909 (in part).
us evides C. H. Eigenmann, 1890, p. 35 (in part).
onsia evides Jordan and Evermann, 1896a, p. 467 (in part).—Starks and Morris, 1907, p. 235 (in part).—Bean and Weed, 1920, p. 80.
onsia elegans montereyensis C. L. Hubbs, 1927, p. 354 (in part).—Jordan, Evermann and Clark, 1930, p. 458.—Schultz and DeLacy, 1936, p. 138.—Clemens and Wilby, 1946, p. 172, fig. 107.
onsia montereyensis C. L. Hubbs, 1948, p. 461 (in part).

This subspecies has a longer first dorsal spine than does *G. m. montereyis*. When the proportion of spine length to head length is plotted, their ndard deviations scarcely overlap (Graph 69). This is true when *G. m.*

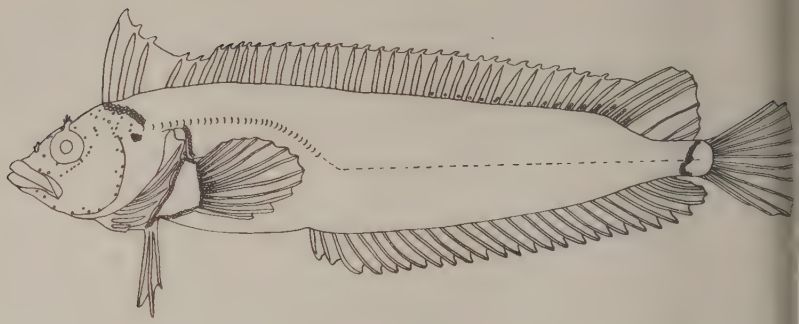
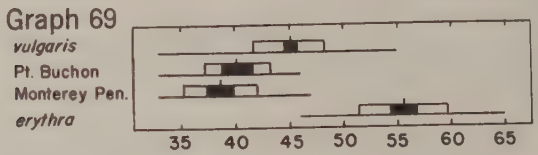
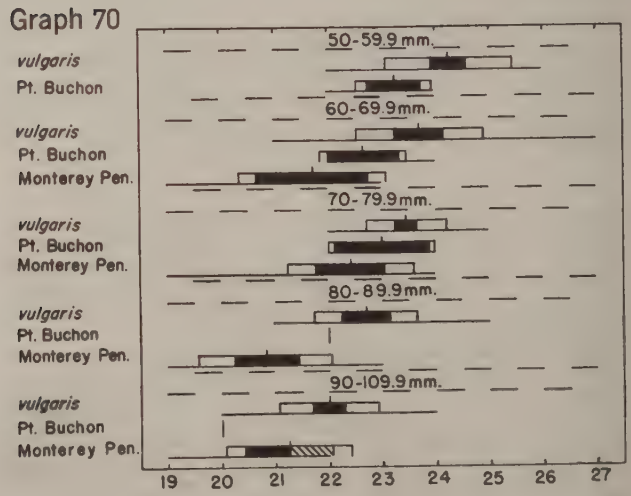


FIG. 53. *Gibbonsia montereyensis vulgaris*, n. subsp. An 84-mm. specimen from TNHC 443. Note scale patches on head and fins.





GRAPHS 69-70. Graph 69. Subspecies of *Gibbonsia montereyensis* compared with *G. erythra*, n. sp. Head length into first dorsal spine length, in percents. Graph 70. Variation in *Gibbonsia montereyensis vulgaris*. Head length into eye length, in percents, by 10-mm. size groups.

ris is compared with the populations of *G. m. montereyensis* from eith-
oint Buchon or the Monterey Peninsula. *G. m. vulgaris* has a larger eye
the subspecies from the exposed coast. When the proportion of eye
th to head length is plotted by size groups, both the Point Buchon and
erey Peninsula specimens have smaller average proportions for all size
ps than the same proportions for the other specimens. Four of the size
p differences are of statistical significance (Graph 70).
lthough in each case the Point Buchon specimens of *G. m. montereyensis*
age closer to *G. m. vulgaris* than do the Monterey Peninsula specimens,
o case can the two populations be separated statistically from each
r.
he specimens of this subspecies were all taken from coasts less sub-
ed to wave action than the areas where *G. m. montereyensis* has been
d.
lamed *vulgaris* (Latin adjective vulgaris, common) for its common occur-
e as compared to *G. m. montereyensis*.
he 98-mm. holotype (SU 40333) was collected by W. I. Follett on May 12,
., from a cove northwest of Bodega Head, Sonoma County, California. The
owing 101 specimens, from 50 to 110 mm., are designated as paratypes:
from Ucluelet, British Columbia, USNM 82150; 67 from Crescent City,
ifornia, UMMZ 63912 and 63913; 10 from Fort Bragg, California, UMMZ
19 and 64338; 7 from south of Buckhorn Creek, Little River, Mendocino
nty, California, CAS 19132; one from Tomales Point, Marin County, Calif-
ia, SU 40285; 11 from Moss Beach, San Mateo County, California, CAS
27 and SU 24648 and 32231; and 4 from between Pillar Point and Moss Beach,
ifornia, UMMZ 64333. The following 173 specimens, from 50 to 84 mm.,
not designated as paratypes because of the discontinuous range of the
species: 9 from Gorda, Monterey County, California, UMMZ 64335; 15 from
r Piedras Blancas, California, UMMZ 62332, 64339, and 64340; four from
r Cambria, California, UMMZ 64336; 6 (intergrades between *G. e. mon-
eyensis* and *G. e. elegans* in type description of *G. montereyensis*) from
nt Arguello, California, UMMZ 64353; 45 from Santa Cruz Island, Califor-
, TNHC 443, CNHM 51436, and CAS 20189, 20490, and 20491; 2 from San
mente Island, California, TNHC 438 and 449; 5 from Los Coronados, Baja
ifornia, TNHC 450 and 451; one from Descanso Bay, Baja California, SU
29; 3 from Todos Santos Island, Baja California, UCLA W49-76; and 83
m Santo Tomas Bay, Baja California, TNHC 432, CAS 20492, and USNM 152003.

Gibbonsia erythra Clark Hubbs, new species
Figure 54

Dorsal XXXIV to XXXVI (XXXIV to XXXV), 6 to 8 (6 to 7); anal II, 25 to
total dorsal and anal rays 67 to 71 (68 to 70); caudal 11; pectorals 12
13 (12); pelvics I, 3; branchiostegal rays 6; anterior lateral line
les 30 to 33; posterior lateral line scales 31 to 35; total lateral line
les 63 to 67; scale rows above the lateral line 150 to 180; gill rakers
o 4 + 9 to 10 = 12 to 14.
Head and snout sharply pointed. Jaws equal. The thick, projecting lips
ntained 1.3 times in suborbital. Upper jaw extends to below a point just
nind front of orbit. The round eye does not enter dorsal profile. Nar-
w interorbital flat to gently convex. Posterior margin of opercle smooth.
ooth posterior margin of preopercle located about midway in postorbital
ny length. Cirri present on each anterior nostril and over each orbit,
sent on nape; those on anterior nostril entire or incised into two lobes;
ose over orbit deeply incised to form fingerlike processes (Fig. 55).
The profile rises evenly and rather rapidly from snout to nape, then more
eeply to first dorsal spine; it is evenly concave for first 6 spines then

level to thirty-second spine, where it drops rather steeply to caudal pec uncle, on which it is again horizontal. Peduncle long and rather narrow. Body compressed to about one-half its depth at anus.

First dorsal spine located slightly in front of posterior margin of op ercle. Dorsal soft rays longer than spines (about same length as firs spine), the first four of approximately equal length; the much shorter pos terior rays form a vertical posterior border to the fin. Tips of last ray do not reach caudal base. First 4 dorsal soft rays are twice as close to gether as following 2 (Fig. 54). Membranes between spines and rays ver slightly incised. The spines bear flags.

First anal spine contained 1.2 and 2.2 times in second spine and firs soft ray respectively. Ray length remains equal as far as eighteenth spine after which rays are longer except for last 2, which are noticeably short er. Tips of last rays do not reach caudal base, the last ray not attache to caudal peduncle by a membrane. Rays in center of fin incised one-half.

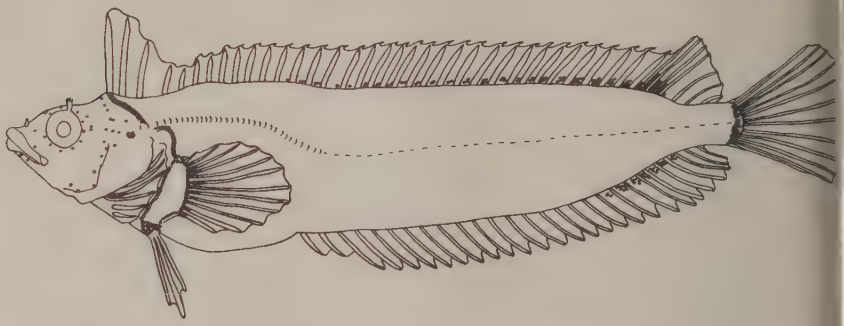


FIG. 54. *Gibbonsia erythra*, n. sp. An 89-mm. specimen from UCLA W5 100. Note scale patches on head and fins.

The eighth ray of the bluntly pointed pectorals the longest. Lower pe toral rays fleshier than upper ones. Second ray of the blunt pelvics t longest; the third the shortest and distinctly separated from second by slightly incised membrane. Membranes between first 2 rays incised tw sevenths.

The small, nonimbricate scales have radii on all their margins, simil to those in *G. elegans* (Fig. 58). Scales cover entire body except pelv base, posterior pectoral base, and midline at nape. Membranes between s dorsal spines behind sixth have one scale near the base. Behind fifteen spine the single scale usually replaced by a patch of 3 or 4 scales. T scales on membranes between first 5 dorsal soft rays arranged in a sing row of about 5 scales. No scales on membranes behind this point. Cauc is naked. A small patch of scales on each membrane between twenty-fif and thirty-third anal soft rays. Pectoral rays scaled for about one-fou their length. Pelvics naked. There may be a patch of scales on upper ma gin of opercle. There may be some scattered scales on cheek. Head othe wise naked.

Lateral line extends posteriorly from opercle in a straight line or g tle arc for about 20 scales, then drops gently to midline, on which it r to caudal peduncle. The scales on the anterior segment usually have an ternal pore above and below the canal near the posterior margin of ea scale (Fig. 56). Those on the posterior portion consist of a pore at e

:oof a tube, similar to those in *G. elegans* (Fig. 60). Canals on head
:pical of the Clininae. A row of pores along each side of each canal.
ne colors exhibited by fresh and preserved specimens are more constant
ie those shown by other members of the genus. Ground color brown to red
coralline. The pattern usually plain with a black ocellus on side below
ith dorsal spine. This phase grades to one with two added ocelli below
:tieth dorsal spine and second soft ray. Frequently in the latter phase
regular barring is obscured by a distinct silver stripe extending back
eye through pectoral. Belly uniformly lighter. Dorsal usually alter-
ly clear and coralline. When present, the coralline marks are continu-
ons of the body bars. In some specimens anterior portion of dorsal has
markings on the rays distally. Caudal color, like that of body near
e, fades distally. Anal ranges from plain to alternately coralline and
nsparent. Pectorals plain. Pelvics are light, with two coralline bars,
iark, with 2 darker bars. Head varies from plain to distinctly marked
n blackish; the most noticeable marking a dark, double bar with a light
eter, extending ventrally from eye, a similar stripe posterior to eye.
iri frequently have dark tips. Often considerable speckling on snout.
ersides frequently light, mottled with dark, or dark, mottled with light.

Figure 55

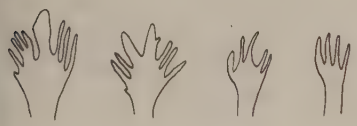
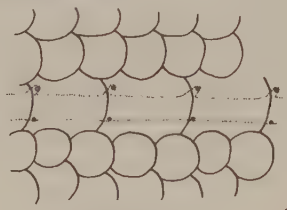


Figure 56



FIGS. 55-56. *Gibbonsia erythra*, n. sp. Fig. 55. Orbital cirri. Fig. 56. Anterior lateral line scales.

This species is known from off Santa Rosa Island and Point Loma, Calif-
nia, and Los Coronados, Baja California. All known specimens were col-
ected by dredges from depths ranging from 8 to 20 fathoms.

It is not possible to determine, without doubt, whether these fisn rep-
esent a species or a subspecies of *montereyensis*. Although there is con-
iderable variation in the extent of the scaled area on the caudal peduncle
f *G. montereyensis*, no specimens were examined which could not properly be
laced either in that species or in *G. erythra*. Tnere was also no correla-
on between scales on caudal peduncle and length of first dorsal spine.
hose specimens of *montereyensis* which had the smallest naked area on the
audal peduncle frequently had the shortest first dorsal spine. Because
ne of the specimens examined are considered intergrades, these deep-water
sh are thought to represent a distinct species recently separated from
ntereyensis.

Although tnis species has many characters in common with *elegans*, it is
efinitely not a member of that species. *G. erythra*, moreover, is not a
ybrid between any of the other species as it is extreme in several charac-
ers, especially in having the longest first dorsal spine.

Named *erythra* (Greek adjective erythros, red) for the typical red ground
olor.

The 55-mm. holotype (SU 16246) was dredged by Fred Tarp and party aboard
ne *Orca* on February 28, 1949, from 10 fathoms in Becher's Bay, Santa Rosa
sland, California. The following 53 specimens, from 50 to 118 mm., are
esignated as paratypes: 37 from the type locality SU 16247; one from 15

fathoms in Becher's Bay, Santa Rosa Island, California, UCLA W49-28; 3 fro 12 fathoms off Ford Point, Santa Rosa Island, California, UCLA W50-100; from 15 to 20 fathoms off East Point, Santa Rosa Island, California, USC one from 8 fathoms off La Jolla, California; 7 from 12 to 13 fathoms of Point Loma, California, NYZS 28818, and CAS 20494 and 20495; and 2 from 12 t 15 fathoms off Los Coronados, Baja California, USNM 151998 and SU 16248.

Gibbonsia elegans (Cooper)
For synonymy see subspecies

The nomenclature of this species is still slightly confused. Coope originally described the species as *Myxodes elegans* and proposed the nam *Gibbonsia* later in the same paper if generic differentiation were possible Cooper ignored or neglected Cuvier and Valenciennes' earlier description *Clinus elegans* from Valparaiso, Chile, which is most probably a synonym c *Calliclinus geniguttatus* (Cuvier and Valenciennes), a member of the trit Labrisomidi. Since neither of these two names proposed by Cuvier an Valenciennes has been coupled with either *Myxodes* or *Gibbonsia*, the nam *elegans* retains validity. The name *evides*, proposed by Jordan and Gilbe (1883b) as a substitute for *elegans*, becomes an unconditional synonym *elegans*.

Vertebrae 16 to 18 + 30 to 32 = 47 to 49; dorsal XXXI to XXXV (XXXII XXXIV), 5 to 8 (6 to 7); anal I to III (II), 21 to 25 (23 to 24); tot dorsal and anal rays 62 to 68 (63 to 66); caudal 10 to 12 (11); pectora 11 to 13 (12); pelvics I, 2 to I, 3 (I, 3); branchiostegal rays 5 to 6 (6 anterior lateral line scales 25 to 42, posterior lateral line scales 24 35, total 62 to 71; scale rows above lateral line 125 to 170; gill rake 4 to 5 + 8 to 12 = 12 to 16.

FIG. 57. *Gibbonsia elegans*. Orbital cirri.

Head and snout bluntly to sharply pointed. Jaws equal, or upper slig ly projecting. Lips contained 1.1 to 1.5 times in suborbital. Poster end of upper jaw extends to a point below anterior third of eye. The ro eye does not enter dorsal profile. The flat-topped interorbital has sl ing sides. Smooth posterior margin of opercle lies under a point betw tnird and fourth dorsal spines. Posterior margin of angular preoper slightly anterior to midpoint of postorbital bony length. Cirri pres over anterior nostril and orbit but absent on nape; those on nostril enti those over orbit fringed (Fig. 57) and are contained less than 2 times interorbital.

The profile is straight to gently convex as it rises rapidly from sn to nape, then rises more steeply to first dorsal spine; from first to fou spines profile is concave; from fifth to twenty-seventh spines it is lev then convex, as it drops to fourth soft ray, where it becomes concave begins to level off, becoming horizontal on caudal peduncle. Peduncle d and very compressed. Body compressed to about two-fifths its depth at an

First dorsal spine inserted over, or slightly anterior to, posterior gin of preopercle. Soft dorsal rays longer than spines. First 3 the gest, the remainder progressively shorter. Tips of last rays do not e reach to caudal base. Soft dorsal rays unequally spaced, each dis-ce between first 4 rays being about one-half that between next 2 (Figs. o 64). Membranes slightly incised except those between fifth and sev-n spines, which are incised one-half. Spines all bear flags.

First anal spine contained 1.2 to 1.3 and 2.0 to 2.5 times in second ne and first soft ray respectively. Ray length equal or decreases ghtly to sixteenth soft ray, then increases except for last 2, which are rter. Tips of last rays do not extend to caudal base, the last ray not ached to caudal peduncle by a membrane. Membranes between rays are in-ed one-half in central portion of fin.

The seventh or eighth ray of the rounded to pointed pectorals the long-; lower rays stouter than upper. Second ray of the short and blunt pel-s the longest; the third the shortest but is distinctly separated from ond by a slightly incised membrane.

The nonimbricate scales have radii on all their margins (Fig. 58). En-e body scaled behind nape and gill slit except for posterior pectoral e. Head naked except for a small patch of scales at anterior dorsal ner of opercle. A triangular patch of scales, which becomes larger pos-iorly, on membrane in front of each spine behind the third. A linear ies of scales on membranes in front of first 4 soft rays. Posterior to rth ray each membrane has only one or 2 scales. Caudal membranes scaled m one-sixth (medially) to one-third (distally) of their length. Each brane in front of anal rays 11 to 21 has a small patch of scales at the e. Pectoral rays scaled for one-fourth to one-third their length. Pel-s may have one or 2 scales near their base.

Figure 58

Figure 59

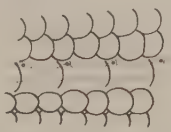
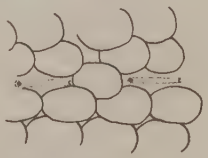


Figure 60



FIGS. 58-60. *Gibbonsia elegans*. Fig. 58. Body scale. Fig. 59. Anter-r lateral line scales. Fig. 60. Posterior lateral line scales.

Lateral line extends posteriorly in a straight line or gentle arc for out 25 scales, then for the next 10 scales drops to midline, on which it ns to caudal fin. Each anterior scale bears an external pore above main nal (Fig. 59). The posterior segment consists of a series of disconnected bes with a pore at each end (Fig. 60). The typical lateral line canals head have a pore on each side of canal.

The color pattern in this species extremely variable. The 3 phases, rred, striped, and plain, are seldom found without some portions of an-her pattern. All 3 phases may be found with a green, brown, red, coral-ne, or orange ground color.

The barred phase has 7 more or less distinct dark bars on body. All but e last 2 typically interrupted dorsally and ventrally. A dark dorsal ddle anterior to the first 5 bars. The dark markings etched with a dark-shade. Entire body has dark specklings. Two or more light-margined, rk ocelli on sides, the first on dorsal portion of first body bar, the cond on dorsal portion of the fifth. If more ocelli present, they are

located similarly on the other dark body bars. Lower sides vary from distinctly lighter to heavily mottled with dark. A dark bar runs across dorsal fin from anterior and posterior margins of each saddle; anterior portion of fin also dark; areas behind third spine and behind fourth soft ray usually transparent. There may be a light bar followed by an interrupted dark bar at base of caudal; caudal rays are mottled, with a cream spot on dorsal and ventral margins about halfway out on fin. Anal may have 6 bars or may be dark. Pectorals and pelvics light or faintly speckled with dark. Head colored like body; three doubled, dark spokes may run from eye: one posterodorsal, one posterior, and one posteroventral; lower sides of head mottled.

The striped phase is similar to the barred except the body bars and saddles are replaced by 5 silver stripes. The most prominent begins on pectoral base and extends to ventral half of caudal peduncle; the next most prominent extends from upper margin of opercle to soft dorsal base; the next runs along a longitudinal axis between first silvar bar and anal base; the last 2 run along dorsal and anal bases respectively.

The plain phase has no body markings except the ocelli, always present in this species; clear spots present behind third dorsal spine and fourth dorsal soft ray. There may be traces of the spoke markings around eye.

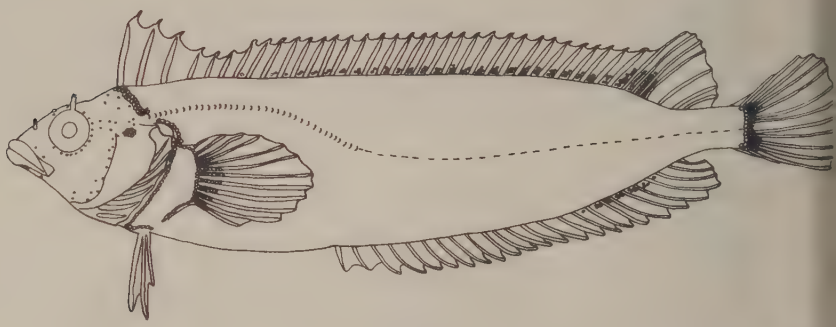


FIG. 61. *Gibbonsia elegans elegans*. A 90-mm. specimen from TNHC 44[illegible]. Note scale patches on head and fins.

These color phases are more or less distributed by habitat. All color patterns or any combinations of them, however, may be found in any one given habitat. The barred phase is typical of tide pools; the striped phase is usually found in the eelgrass beds in the bays; and the plain phase is typically found in deeper water.

Gibbonsia elegans has a recorded range between Piedras Blancas, California, and Abreojos Point, Baja California. It is common only south of Point Conception, California, and north of Port San Bartolomé, Baja California. There is a very strong possibility that it ranges as far south as Magdalena Bay, Baja California, as a single specimen is in the collection of the California Academy of Sciences with "Magdalena Bay?" as its locality. This specimen is undoubtedly from the southern portion of the range as it agrees very closely with the Abreojos specimens in all morphological characters checked.

There is a very great deal of morphological variation within the range of this species. A large number of subspecies could be described on the

is of the populations examined. A more or less conservative evaluation the data leads the author to accept four subspecies: *elegans* from the e pools along the coasts of the mainland, Los Coronados, and the Channel ands; *velifera* from deep water off southern California and northern Baja ifornia, as well as in bays of the same area (San Quintin Bay, Estero de ta Banda, San Diego Bay, Mission Bay, and Newport Bay), and the coast ie between Point Conception and Piedras Blancas in central California; *oli* from tide pools on Guadalupe Island; and *rubrior* from deep water off dalupe Island. The population on the San Benito Islands probably repre- its intergrades between *elegans* and *erroli*. The mainland specimens from ith of Point San Eugenio approach *erroli* but are still considered as *ele-* is.

Gibbonsia elegans elegans (Cooper)
Figure 61

xodes elegans Cooper, 1864, p. 108, fig. 23 (type locality Point Loma, San Diego County, California; holotype, CAS 707, destroyed in 1906, SU 16318 here designated as neotype).

bbonsia elegans Cooper, 1868, p. 492 (in part).—Rosa Smith, 1880a; 1880b, p. 147.—Jordan and Gilbert, 1880c, p. 25; 1881a, p. 454 (in part); 1881b, p. 63 (in part).—Jordan and Jouy, 1881, p. 4 (in part).—Jordan and Evermann, 1896a, p. 467 (in part); 1898, p. 2353.—Jordan and McGregor, 1899, p. 284.—Greeley, 1899, p. 20 (in part).—Starks and Morris, 1907, p. 232.—Evermann and Latimer, 1910, p. 139 (in part).—Metz, 1912, p. 45 (in part), figs. 15-17, pl. 4.—Osburn and Nichols, 1916, p. 178.—Fowler, 1924, p. 293, 300 (in part).—Jordan, Evermann, and Clark, 1930, p. 458.—Fowler, 1944, p. 521.

lakea elegans Steindachner, 1876, p. 197 (in part).

inus (*Gibbonsia*) *evides* Jordan and Gilbert, 1883b, p. 763 (in part; name substituted for *Myxodes elegans* Cooper).—Jordan, 1885a, p. 909 (in part).

linus evides Rosa Smith, 1883b, p. 235 (in part); 1885a, p. 45 (in part).—C. H. Eigenmann, 1890, p. 35 (in part).—Eigenmann and Eigenmann, 1892, p. 357 (in part).

linus ocellifer Mocquard, 1889, p. 40, 44 (type locality California coast; syntypes in Paris Museum).

ibbonsia evides C. H. Eigenmann, 1892, p. 171, 173 (in part).

ibbonsia elegans elegans C. L. Hubbs, 1927, p. 354.—Barnhart, 1936, p. 86, fig. 257.

This subspecies has the widest range of all members of the species and s the form recorded extensively in the literature. Although there is con- iderable variation within it, it forms a unit when compared with the other hree subspecies.

Together with *G. e. velifera*, this subspecies can be separated from *G. . erroli* and *G. e. rubrior* by number of dorsal spines (Graph 71). The standard deviations of all except two populations here considered as *G. e. legans* or *G. e. velifera* do not overlap the standard deviations of *erroli* or *rubrior*. The standard deviations of the two exceptions scarcely overlap hat of *erroli*. Since the specimens from the San Benito Islands are almost ntermediate in this character, they are considered as intergrades. The opulations of *G. e. elegans* or *G. e. velifera* which have the lowest dorsal spine count come from south of Point San Eugenio.

G. e. elegans and *G. e. velifera* have shorter longest pectoral rays than do *G. e. erroli* and *G. e. rubrior* (Graph 72). Without exception the popu- lations of *G. e. erroli* and those of *G. e. elegans* or *G. e. velifera* can be

separated statistically when the proportion of longest pectoral ray leng to standard length is plotted. *G. e. erroli* has a noticeable overlap standard deviations in this character with only the four most southern po ulations of *G. e. elegans*. On the same table the few specimens of *G. rubrior* can be separated with doubtful statistical validity from all pop lations of *G. e. elegans* and *G. e. velifera* except those from south of Poi San Eugenio. The population from the San Benito Islands is intermedia between *elegans* and *erroli*.

Gibbonsia elegans elegans can be distinguished from *E. e. velifera* its shorter caudal peduncle length (Graph 73). All populations listed tne graph and considered as *elegans* have an average proportion of cauda peduncle length to head length of less than 38.4%, while those considere as *velifera* have a proportion greater than 38.5%. In most instances moreover, the standard deviations of *elegans* do not overlap those of *errol* This is most impressive when the large series from deep water off Los Co onados, Baja California, and Becner's Bay, California, those from San Qui tin Bay, Baja California, and those from Point Conception to Piedras Blanc and Newport Bay, California, are compared with those from the tide pools Abreojos Point, Cape Tortolo, the Cape San Quintin to Hondo Canyon are Santo Tomas Bay, Morro Light, and Los Coronados, Baja California, and S Diego, Santa Barbara, and Santa Cruz Island, California. The specimens *elegans* from 1.5 miles south of Arroyo Descanso, Baja California, and L Angeles, California, approach *velifera*. The specimens of *velifera* fr Mission Bay, California, approach *elegans*.

Gibbonsia e. elegans can further be distinguished from *G. e. velifera* its shorter first dorsal spine (Graph 74). All populations listed in t table and considered as *elegans* which do not approach *erroli* have an ave age proportion of first dorsal spine to snout-to-dorsal length of less tn 49%, while those considered as *velifera* have a proportion greater than 50 There is little or no overlap between the standard deviations of any of t populations of *velifera* and the populations of *elegans* from Santa Tomas B and Morro Light, Baja California, and San Diego, California. There is likewise little or no overlap between the standard deviations of any of t populations of *elegans* south of Point San Eugenio, Baja California, and t populations of *velifera* from Newport Bay, California, and the deep wate off Los Coronados, Baja California.

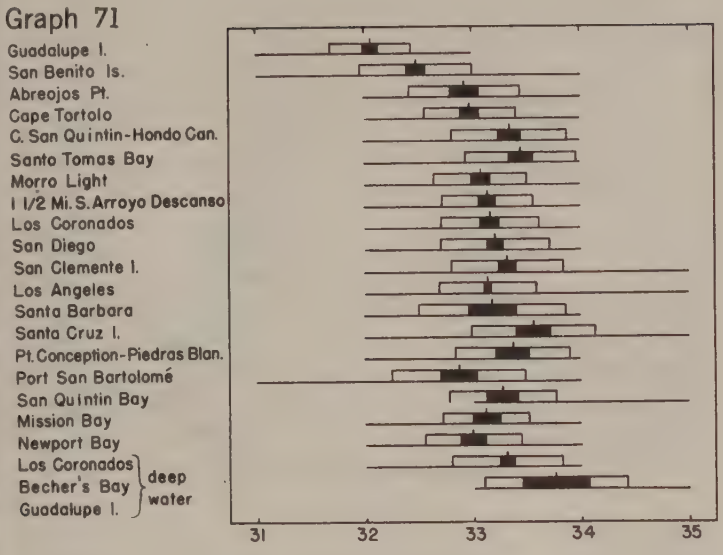
Most populations of *G. e. elegans* have a statistically shorter propor tion of first anal soft ray to head length than do most populations of *e. velifera* (Graph 75). The only exceptions are the populations of *elegans* from Abreojos Point and Point San Bartolomé, Baja California, and Los An geles and Santa Barbara, California, and the *velifera* population from San Quintin Bay, Baja California.

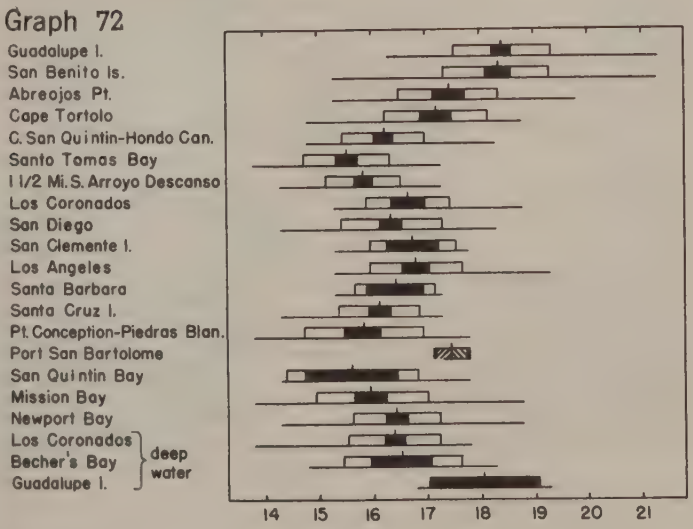
Most populations of *G. e. elegans* have a statistically shorter propor tion of second dorsal soft ray length to head length than do most popula tions of *G. e. velifera* (Graph 76). The exceptions in this graph are t same populations of *elegans* which are the exceptions in the first anal so ray proportions, and the population of *velifera* from Mission Bay.

Many of the populations of *elegans* have a statistically greater propor tion of body depth to standard length than do the populations of *velifer* (Graph 77). The deep body is especially characteristic of those populatio which do not show a statistical difference in the 2 characters listed i mediately above.

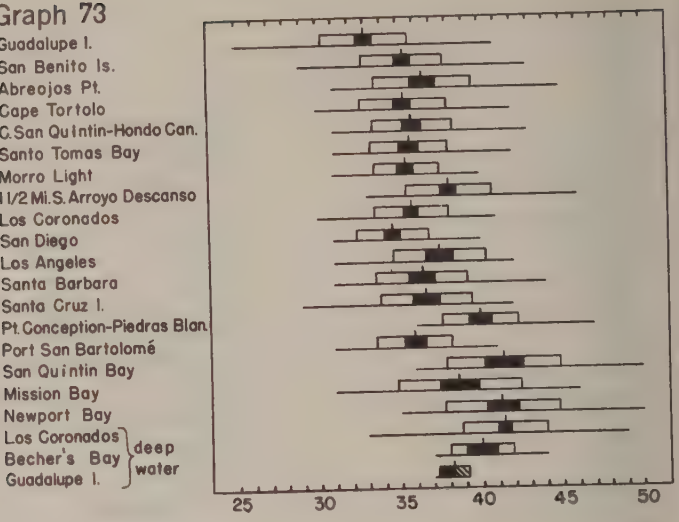
In all cases *elegans* has a larger average proportion of head length standard length than does *velifera* (Graph 78). With the exception of t Becher's Bay and San Quintin Bay populations this difference always h statistical significance.

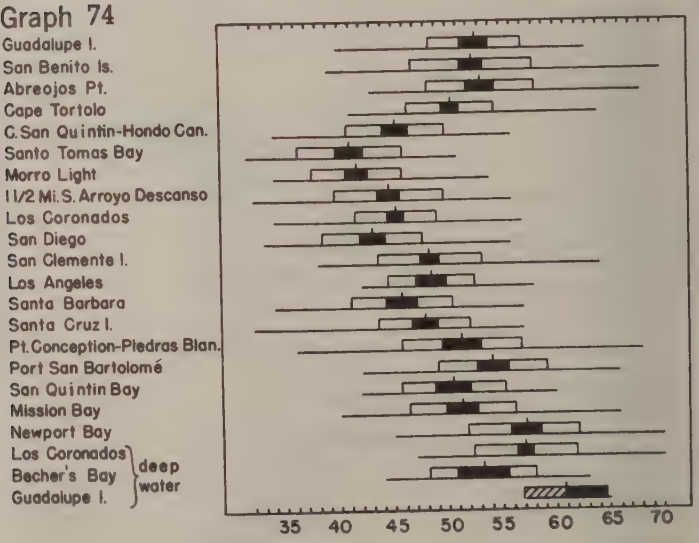
Within the subspecies *elegans* many of the characters listed vary consi erably. The populations from south of Point San Eugenio, Baja Californi (Abreojos Point, Cape Tortolo, and Point San Bartolomé), approach *G.*





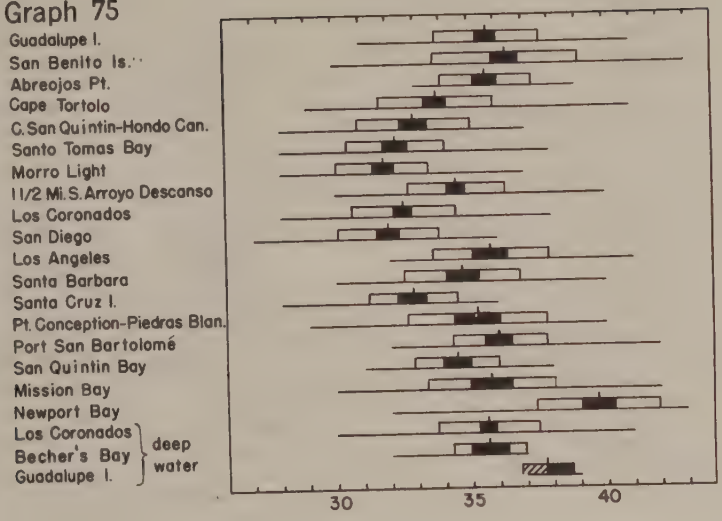
GRAPHS 71-72. Subspecies of *Gibbonsia elegans*. Graph 71. Dorsal spines. Graph 72. Standard length into pectoral length, in percents.



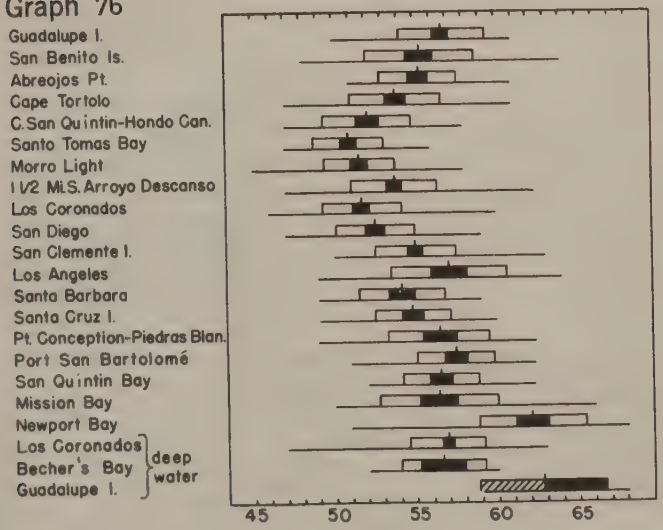


GRAPHS 73-74. Subspecies of *Gibbonsia elegans*. Graph 73. Head le into caudal peduncle length, in percents. Graph 74. Snout-to-dorsal tance into first dorsal spine length, in percents, minus 2% for each 10 of standard length.

Graph 75

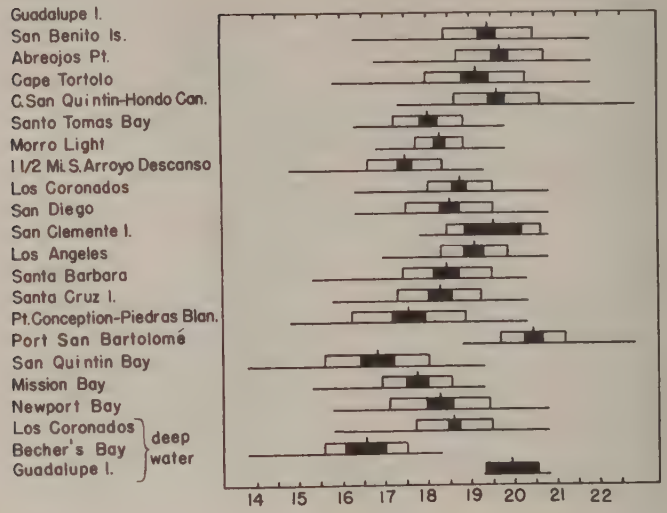


Graph 76

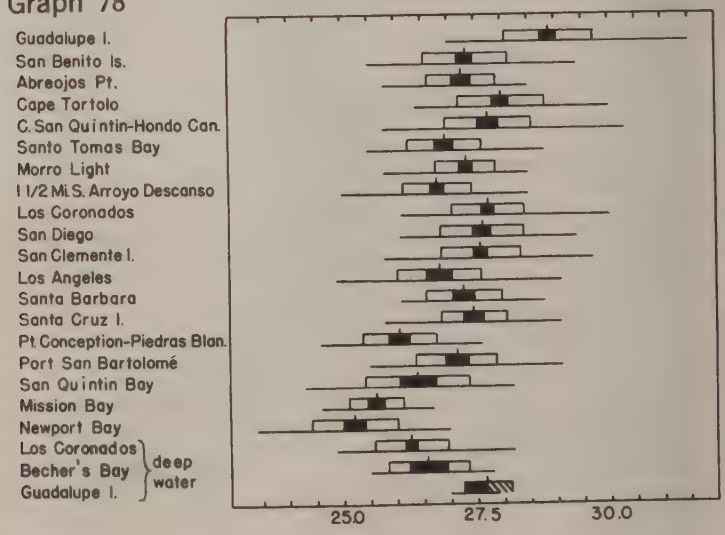


GRAPHS 75-76. Subspecies of *Gibbonsia elegans*. Graph 75. Head length to first anal soft ray length, in percents. Graph 76. Head length into second dorsal soft ray length, in percents.

Graph 77

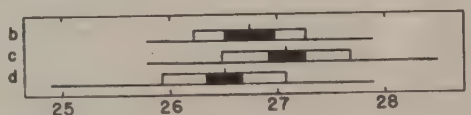


Graph 78



GRAPHS 77-78. Subspecies of *Gibbonsia elegans*. Graph 77. Standa length into body depth, in percents, minus 0.5% for each 10 mm. of standa length. Graph 78. Standard length into head length, in percents, plus 0. for each 10 mm. of standard length.

in all characters by which that subspecies differs from *G. e. ele-*
For instance, there is little or no overlap between the standard
ions of these populations and those from Santo Tomas Bay and 1.5
south of Arroyo Descanso, Baja California, in the proportion of pec-
length to standard length (Graph 72).
siderable variation within the subspecies is found in the proportion
st dorsal spine length to snout-to-dorsal length (Graph 74). The
shows that this proportion is greater in the specimens from Abreojos
Cape Tortolo, and Port San Bartolomé, Baja California, and Los An-
California. There is little or no overlap between the standard de-
ns of the proportions for these populations and those from Santo
Bay and Morro Light, Baja California, and San Diego, California. The
pulations from Santo Tomas Bay and Morro Light also differ greatly in
ove proportion from the populations from San Clemente and Santa Cruz
s, California.
re is also considerable variation within *G. e. elegans* in the propor-
of first anal soft ray to head length (Graph 75). There is no over-
tween the standard deviations of the larger proportions found in the
ens from Abreojos Point and Port San Bartolomé, Baja California, and
geles, California, and those of the smaller proportions of the speci-
rom Morro Light, Baja California, and San Diego, California.
bonsia elegans elegans also varies in the proportion of second dorsal
ay to head length (Graph 76). There is no overlap between the stand-
eviations of the larger proportions found in the Port San Bartolomé,
California, population and those of the smaller proportions of the
ations from the Cape San Quintin to Hondo Canyon area, Santo Tomas
Morro Light, and Los Coronados, Baja California, and San Diego, Calif-
. Moreover, there is no overlap between the standard deviations of
naller proportions found in the population from Santo Tomas Bay, Baja
ornia, and the larger proportions of the Los Angeles, California, pop-
on.
nally, the intrasubspecific variation is shown by the proportion of
deptn to standard length (Graph 77). There is no overlap between the
ard deviations of the larger proportions of the Port San Bartolomé,
California, population and those of the smaller proportions of the
ations from the Cape San Quintin to Hondo Canyon area, Santo Tomas
Morro Light, and 1.5 miles south of Arroyo Descanso, Baja California,
an Clemente Island, Los Angeles, Santa Barbara, and Santa Cruz Island,
ornia. Likewise there is little or no overlap between the standard
tions of the smaller proportions of the populations from the Cape San
in to Hondo Canyon area, Santo Tomas Bay, and Morro Light, Baja Calif-
., and those of the larger proportions of the population from Cape Tor-
Baja California.
check was made to determine whether there was any variation among the
mens from one geographic locality. The locality selected was the sta-
1.5 miles south of Arroyo Descanso. The specimens from that locality
all collected on February 2, 1945, from high (b), mid (c), and low (d)
pools. Although some variation was apparent among specimens from
three sublocalities, the differences were of statistical significance



RAPH 79. *Gibbonsia elegans elegans.* Variation within samples from the
locality (1.5 miles south of Arroyo Descanso). Standard length into
length, in percents, plus 0.3% for each 10 mm. of standard length.

only in the proportion of head length to standard length (Graph 79). T
difference, although statistically significant, is not of major impo
The other nonsignificant differences do not show a correlation between
locations on the reef in relation to the tide level.

It is readily apparent that the fishes here considered belonging to
subspecies *Gibbonsia elegans elegans* might be separated into at least
subspecies. These would be composed of tne populations from Cape San Q
tin, Hondo Canyon, Santo Tomas Bay, Morro Light, Arroyo Descanso, and
Coronados, Baja California, and San Diego, California, on one hand, and
the other, the populations from Abreojos Point, Port San Bartolomé,
Cape Tortolo, Baja California, and San Clemente Island, Los Angeles,
Santa Cruz Island, California. One population, from Santa Barbara, Calif
nia, did not show marked differences from any other population of *G.*
elegans. If the data are examined carefully, it will be seen that when
Abreojos Point, Port San Bartolomé, and Cape Tortolo populations dif
from other members of *G. e. elegans* in a given character, they appro
G. e. erroli. The three above populations of *G. e. elegans*, although
called intergrades, have a definite tendency to approach *erroli* in
morphological characters. Likewise, if the data are examined carefully,
will be seen that when the San Clemente Island, Los Angeles, and Santa
Island populations differ from other members of *G. e. elegans* in a gi
character, they approach *G. e. velifera*. These three populations of *G.*
elegans (especially the one from Los Angeles), although not called int
grades, have a definite tendency to approach *velifera* in many morpholog
characters. From the above information it becomes apparent that variat
within this subspecies are caused merely by the influences of two o
subspecies of the same species. It would be unfortunate to base a sub
cies on populations of one subspecies which have a tendency to approach
other subspecies of the same species. This "subspecies" would be diphyl
as it would show two separate lines of evolution. The Baja California p
lations from Cape San Quintin, Hondo Canyon, Santa Tomas Bay, Morro Li
Arroyo Descanso, and Los Coronados, and the California population from
Diego are the least contaminated with *erroli* and *velifera* characters.
these the Santo Tomas Bay and Morro Light populations are believed to
tain the purest samples of *G. e. elegans*.

The single specimen recorded doubtfully as being from Magdalena B
included witnin this subspecies since it agrees closely with the Abr
population in all characters checked.

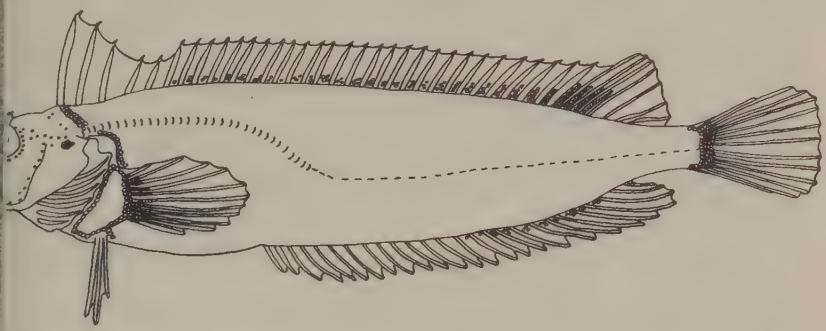
Since the holotype was destroyed, SU 16318 is designated here a
neotype. This 81-mm. specimen was collected by Carl L. Hubbs and par
June 1, 1946, from a tide pool on Bird Rock, San Diego, California.
following 1741 tide pool specimens, from 50 to 131 mm., were also exa
one from Magdalena Bay, Baja California, CAS 776; 64 from Abreojos P
Baja California; 20 from the west point of Ballenas Bay, Baja Califo
CAS 20475; 109 from Cape Tortolo, Baja California, including SU 1632
from Port San Bartolomé, Baja California, CAS 20477, SU 16327, USNM 1
TNHC 424, 428, and 439, and CNHM 51431; 20 from 2 miles north of Hond
yon, Baja California; 37 from 2 miles south of the mouth of Rio Soc
Baja California; 53 from Cape San Quintin, Baja California, includi
15337; one from San Martin Island, Baja California, SU 5912; 88 from
Tomas Bay, Baja California, SU 16321 and CAS 20474; 103 from 0.5 miles
of Morro Light, north of Ensenada, Baja California, TNHC 441; 223 fr
miles south of Arroyo Descanso, Baja California, including SU 163
TNHC 434; 178 from South Coronado, Baja California, SU 16320 and TNH
51 from Point Loma, California, CAS 20472; 142 from Bird Rock, San
California, including SU 16319; 40 from the vicinity of La Jolla, Ca
nia, including TNHC 447; 12 from Point Fermin, California, UMMZ 1306
from White Point, California, UMMZ 130960 and 141272; 113 from Inspi
Point, California; 111 from Portuguese Bend, California; 2 from Santa

sland, California, UMMZ 64342 and 64343; 153 from San Clemente Is- California, CAS 20473 and SU 16323 and 16325; 51 from Santa Cruz Is- CAS 20476; 2 from near Carpinteria, California, UMMZ 63946; one from Gorda, California, UMMZ 64346; and 56 from Santa Barbara, California, 4, 55, 56, 57, 60, 61, 72, 73, 74, 84, 89, 101, 102, 106, and 107.

Gibbonsia elegans velifera Clark Hubbs, new subspecies
Figure 62

ısia elegans elegans × *montereyensis* (intergrades) C. L. Hubbs, 1927, p. 354.

ıs subspecies is separated from *G. e. elegans* under that heading. It so separated from *G. e. erroli* and *G. e. rubrior* under the same head- In addition, *G. e. velifera* has a shorter head than either *G. e.* l or *G. e. rubrior* (Graph 78). Frequently there is no overlap between proportions, and in all cases the standard deviations do not overlap. ishes of *G. e. erroli* and *G. e. rubrior* have a statistically deeper than any populations of *G. e. velifera* (Graph 77).



G. 62. *Gibbonsia elegans velifera*, n. subsp. A 77-mm. specimen from 449. Note scale patches on head and fins.

s was demonstrated for *G. e. elegans*, there is considerable intrasub- fic variation among the populations of *G. e. velifera*. The population deep water off Becher's Bay, California, has a statistically greater er of dorsal spines than does any other population of the subspecies ot the most northern (Graph 71). The difference in the latter case is oubtful statistical significance. The populations from Newport Bay and ion Bay, California, have a statistically shorter proportion of head th to standard length than do the other populations of the subspecies ph 78). The same two populations and that from deep water off Los nados, Baja California, have a statistically larger proportion of cau- peduncle length to head length than does the population from San Quin- Bay, Baja California (Graph 75). The populations from deep water off Coronados, Baja California, and from Newport Bay, California, have a istically greater proportion of first dorsal spine length to snout-to- al length than the other populations of *G. e. velifera* (Graph 74). The lation from Newport Bay has a statistically greater proportion of first soft ray length to head length and second dorsal soft ray length to length than do the other populations of the same subspecies (Graphs 75 76). The standard deviation of this population, moreover, shows little

or no overlap with the standard deviations of the remaining populations in these characters.

As was true for *G. e. elegans*, it would be possible to further subdivide *G. e. velifera* into two subspecies on the basis of the evidence presented above. These subspecies would be, on one hand, the population from Newport Bay, California, and on the other hand, the remaining populations. Closer examination of the data, however, will reveal that bay populations tend to vary considerably, perhaps due to the semi-isolation of their small populations from the theoretically continuous offshore population. The Newport Bay population is not named since it has probably been derived too recently from typical *velifera*. Although the Mission Bay and San Quintin Bay populations approach *G. e. elegans* in many morphological characters, they are not considered as intergrades.

This subspecies may or may not have a discontinuous range. It is believed, however, that there is an uninterrupted band of *G. e. velifera* along the coast between 5 and 16 fathoms. This population has been sampled off Los Coronados and San Telmo Point, Baja California, and La Jolla and Becher's Bay, Santa Rosa Island, California. The subtidal population has sent out numerous side branches into the semi-isolated and protected bays along the mainland coast. Samples have been obtained from San Quintin Bay and Estero de Punta Banda, Baja California, and San Diego, Mission, and Newport Bays, California. The members of the deep-water subspecies are constantly moving upward toward the tide pool zone, and the members of the tide pool zone are moving down into the subtidal zone. This continuous "battle" between the two subspecies causes an oscillation of the area of intergradation. In some areas one subspecies may gain the upper hand and take over the range of the other. This invasion has apparently taken place at Point Conception and Piedras Blancas, where the area of the tide pool zone suitable for this species is so narrow that the small population of *G. e. elegans* was probably swamped by the population of *G. e. velifera* from below the low-tide level.

Because of the variability of the populations within this species only the specimens from deep water off Los Coronados Islands, Baja California are considered as paratypes.

Named *velifera* (Latin adjective velifer, sail-bearing) for the sail-like anterior crest of the dorsal fin.

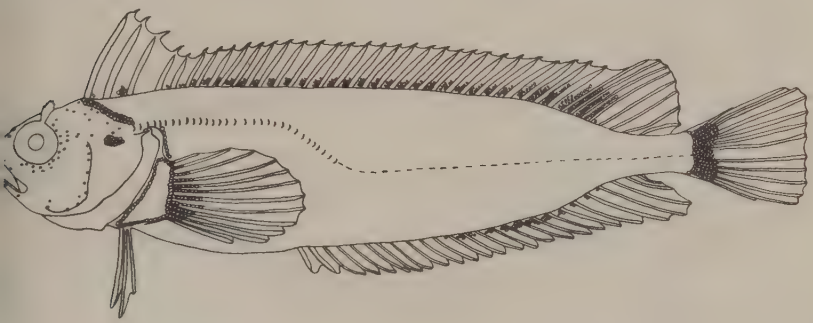
The 73.5-mm. holotype (SU 16258) was dredged by J. W. Sefton and party on December 22, 1948, from 10 fathoms off the east side of South Coronado, Baja California. The following 403 specimens, from 50 to 111 mm., dredged from various depths at the type locality are designated as paratypes: 1 from 5 fathoms; 54 from around 6 fathoms, USNM 152001, CAS 20482, and RUC 237 from around 8 fathoms, CAS 20480 and 20481, CNHM 51435, and TNHC 445; 5 from 10 fathoms, SU 16259, 16265, 16267, 16269, and 16270; 8 from 11 fathoms, TNHC 407; 7 from 12 fathoms, NYZS 28817; 6 from 13 fathoms, SU 16268 and 16 from around 16 fathoms, CAS 20483. The following 237 other specimens, from 50 to 140 mm., were examined: 18 dredged from 10 fathoms off Becher's Bay, California, SU 16271; one from San Telmo Point, Baja California, SU 16317; one from 12 fathoms off La Jolla, California, SU 16261; 4 from San Quintin Bay, Baja California, SU 15276, 15305, and 15317; 3 from Estero de Punta Banda, Baja California, SU 16260, CAS 20486, and USNM 123404; 2 from San Diego Bay, California, SU 16262; 58 from Mission Bay, California, SU 16264, CAS 11446, USNM 152004, RUC, TNHC 427, and CNHM 42551 and 42550; 63 from Newport Bay, California, NYZS 28816, USNM 152005, UCLA W49-374, TNHC 426, CAS 20484, 20485, and 20487, and SU 16263; 13 from Point Conception, California, SBSC 83, 85, and 88, and UMMZ 64354 (intergrade in type description of *montereyensis*); 5 from Point Arguello, California, UCLA W48-31; one from Point Sal, California, UMMZ 64352 (intergrade in type description of *montereyensis*); 20 from 3 miles north of Cayucos, Califo

UCLA W49-158; and 11 from Piedras Blancas, California, UMMZ 64340 types of *montereyensis*).

Gibbonsia elegans erroli Clark Hubbs, new subspecies
Figure 63

his subspecies, together with *G. e. rubrior*, is separated from *G. e. fera* and *G. e. elegans* in the discussion of the latter subspecies and separated further from *G. e. velifera* in the discussion of the latter pecies.

. e. erroli can be distinguished not only from *G. e. rubrior* but also the other two subspecies by a statistically smaller proportion of caudeduncle length to head length (Graph 73). The differences between subspecies and *G. e. rubrior* are so large that their standard deviaons do not overlap. Likewise, the standard deviations of the two Guada- Island subspecies in the proportion of first dorsal spine length to t-to-dorsal length do not overlap (Graph 74). As is true with the lations from off the mainland, the deep-water specimens from Guadalupe nd have the longer first dorsal spine. The proportion of second dorsal



IG. 63. *Gibbonsia elegans erroli*, n. subsp. An 87-mm. specimen from 446. Note scale patches on head and fins.

ray length to head length in the Guadalupe Island populations again allels that for specimens from along the mainland; the proportion is ger in those from deep water; in Graph 76 there is little overlap be- en the standard deviations.

Although this Guadalupe Island endemic subspecies is probably geographlly isolated from all other members of the same species except *rubrior*, is not believed that it has become sufficiently differentiated for spec rank. The presence on West Benito Island of a population obviously ermediate between *G. e. erroli* and *G. e. elegans* lends support to the othesis that these specimens are only subspecifically separated from *G. elegans*.

Named *erroli* for Errol Leslie Flynn.

The 82.5-mm. holotype (SU 16255) was collected on December 8, 1946, by l L. Hubbs and party from a tide pool on Guadalupe Island, Baja Californ. The following 114 specimens, from 50 to 120 mm., collected from the e locality, are designated as paratypes: TNHC 446 and 452, SU 16256 and 57, CNHM 51432, NYZS 28821, RUC, USNM 151999, and CAS 20488. The fol-

lowing 142 other specimens, from 50 to 124 mm., from west San Benito, Ba California, are considered as intergrades between this subspecies and *G. e. elegans*: SU 16328 and TNHC 405 and 440.

Gibbonsia elegans rubrior Clark Hubbs, new subspecies
Figure 64

This subspecies is separated from *G. e. elegans*, *G. e. velifera*, an *G. e. erroli* in the discussions of those subspecies.

Although only 4 specimens of this subspecies have been examined, t differences between these specimens and all others of the species are be lieved sufficient to merit subspecific rank. The differences between *G. e rubrior* and *G. e. elegans* parallel those between *G. e. velifera* and *G. e elegans*. Likewise the difference between *G. e. rubrior* and *G. e. velifer* parallel those between *G. e. erroli* and *G. e. elegans*. It is purely a ma ter of conjecture whether this subspecies has been derived from *G. e. er oli* in the same manner in which *G. e. velifera* was derived from *G. e. el egans* or whether it has been derived from *G. e. velifera* in the same way which *G. e. erroli* was derived from *G. e. elegans*. It is most probab that both hypotheses are partially correct and all four subspecies wer more or less derived from one another or from a common ancestor.

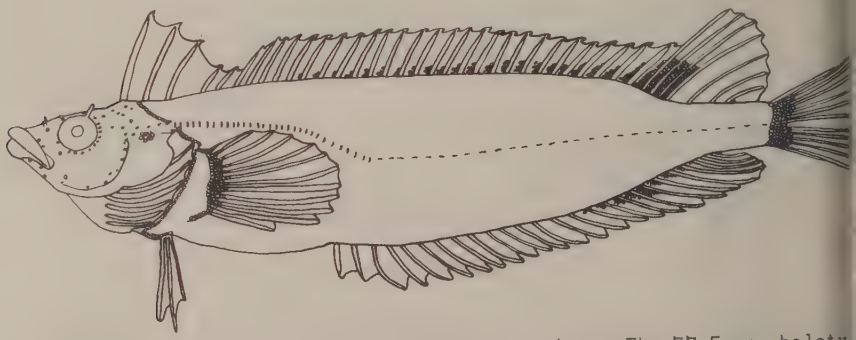


FIG. 64. *Gibbonsia elegans rubrior*, n. subsp. The 77.5-mm. holoty SU 16272. Note scale patches on head and fins.

Named *rubrior* (Latin adjective ruber, red) for its redder color w compared with *G. e. erroli*.

The 77.5-mm. holotype (SU 16272) and 3 paratypes, from 54 to 66 mm., 16273) were dredged by Carl L. Hubbs and party on the *Orca* on January 1950, from 22 to 26 fathoms in Melpomene Cove, Guadalupe Island, Mexic

III. ZOOGEOGRAPHY

See Maps 1 and 2, pages 46 and 47

The early writers on the zoogeography of marine fauna of Central Amer concentrated on determining whether the fauna of the Caribbean was dist from that of the Pacific. Meek and Hildebrand (1923) summarized the thyological work and concluded that although the faunas were related were distinct from one another. These authors, however, added (p. "The ichthyological fauna of the Pacific coast of Panama, therefore, app

r.ge from the Gulf of California to Ecuador....." The results obtained .n his paper agree with Ekman's (1935) assumption, based on invertebrate e.igations, that this 4000-mile coast line is subdivided into several .ces. It is believed that the results gained from the present study c.nid distribution may more accurately locate the boundaries between rovinces of the tropical Eastern Pacific faunal region.

Je zoogeographic information gathered from the present study is exem- .ed by the distribution of the six Pacific species of the genus *Para- s* (*monophthalmus, mexicanus, beebei, altivelis, integripinnis*, and *ri*). *Paraclinus monophthalmus* has been collected only between Bania , Panama, and Ecuador, except for a single specimen from Port Parker, Rica, where *P. mexicanus* abounds. Likewise, *P. mexicanus* has never recorded southeast of Bahia Honda, Panama, except for a single speci- rom Perico Island, Panama, where *P. monophthalmus* is common. At the .ern end of its range *P. mexicanus* has never been recorded north of as, Sonora, and La Paz, Baja California. Available collections indi- that this species is common in the southern end of the Gulf of Calif- , and gradually becomes less abundant northward. It is assumed that the little-known area between Abreojos Point and Cape San Lucas is ected extensively, *P. mexicanus* will be found on the Pacific Ocean side e peninsula. *P. altivelis altivelis* is recorded only from La Paz ward in the Gulf of California; the other subspecies of this species, has been collected in the sandy bays on the Pacific Ocean side of the nsula. *P. integripinnis*, as defined in this paper, has not been re- ed south of Abreojos Point, Baja California. Of the two subspecies, more southerly, *P. i. zacae*, ranges from Abreojos Point north along the land to the vicinity of San Telmo Point, Baja California, where it in- rades with *P. i. integripinnis*, common in southern California. The er is also found off the San Benito Islands and Guadalupe Island. *P. ei*, which has a wide recorded range (from Bahia Honda, Panama, to Arroyo , Baja California), apparently ranges the same geographic area as does *exicanus*, but in deeper water. The last species, *P. walkeri*, is re- cted to San Quintin Bay, Baja California, and apparently has been de- d recently from *P. integripinnis*.

he author believes that the genus *Paraclinus* acts as an index group for fish fauna of the tropical Eastern Pacific region. The southern bound- is indefinite because it undoubtedly lies somewhere along the little- ected coast line of southern Ecuador and northern Peru. The tentative gnation by Myers (1941) of a boundary "just below the Guayas estuary at Aguja" may well prove to be correct. The location of a major boundary e in this area is indicated by the absence of *Paraclinus* as well as er northern clinid genera (*Mnierpes, Malacoctenus*, and *Starksia*) to the h and by the absence of the southern genera (*Calliclinus, Auchenionchus, sichthys*, and *Myxodes*) on the mainland to tne north. This same area s as the zone of contact between *Labrisomus philippii* and the Panamanian resentative of the genus. The large number of generic changes in the a indicates that it is a boundary between major zoogeographic regions; ., between the tropical Eastern Pacific faunal region and south temper- Eastern Pacific faunal region.

The range of *P. monophthalmus* seems to coincide with the Panamanian pro- ce of the tropical Eastern Pacific faunal region. The southern boundary this province is discussed above. The northern boundary apparently lies the vicinity of Bahia Honda, Panama. The existence of a boundary line this region is supported by the separation of *Mnierpes macrocephalus* o two subspecies: *macrocephalus* southeast of Bahia Honda and *catherinae* the northwest; the specimens taken at Bahia Honda are intergrades. This e area seems also to be the boundary separating two species of *Branner- a*, two species of *Labrisomus*, and two southern and four northern species

of *Malacoctenus*. The distribution of species of the serranid genus *Rypticus* also points to the existence of a boundary line in this area since *R. nigripinnis* has been reliably recorded only to the soutneast of Bahia Hond and *R. maculatus* to the northwest.

The ranges of *Paraclinus mexicanus* and *P. beebei* indicate the extent o the Mexican province. The southern boundary of this province is discusse above. The Mexican province contacts two others to the north, that of th Gulf of California and the north temperate Eastern Pacific faunal region. The boundary between the former and the Mexican province is located nort of Mazatlan on the mainland and around La Paz on the peninsula. This sam area seems to be the zone of contact between *Starksia cremnobates* and a undescribed species of *Brannerella, Labrisomus xanti* and an undescribe species of that genus, and four southern and two northern species of *Malacoctenus*. The zone of intergradation between two subspecies of the serrani *Paralabrax maculatofasciatus* falls in the same area.

It is believed that the supposed zone of contact between *Paraclinus integripinnis* and both *P. mexicanus* and *beebei* lies slightly farther sout than the boundary between the Mexican province and the north temperate Eastern Pacific faunal region. The area between Abreojos Point and Por San Bartolomé is believed to be the dividing line for most species. The genera *Gibbonsia* and *Heterostichus* become common as *Labrisomus* and *Malacoctenus* become rare. Many other temperate-water fishes north of this are occupy ecologic niches which are assumed by tropical fishes farther south

Ekman (1935) was undecided as to the existence of a distinct provinc between Panama and Baja California. The present author believes that th distribution of clinid fishes outlines the boundary of such a province This province may possibly be divided into three subprovinces: (1) sout of Guatemala, as shown by the distribution of *Mnierpes macrocephalus cath erinae*; (2) the Mexican mainland, as shown by the distribution of *Para labrax*; and (3) the southern portion of Baja California, as shown by a undescribed species of *Labrisomus* and by the distribution of *Paraclinu altivelis* and *Exerpes* outside of the Gulf of California.

The Gulf of California province, recognized by Ekman (1935) on the basi of invertebrate investigations, is clearly defined by clinid distributiona records. The boundary is discussed above. This province is undoubtedly part of the tropical Eastern Pacific faunal region. Except for the gen *Paraclinus* no Gulf of California clinid genus has a representative on th part of the mainland occupied by the north temperate Eastern Pacific faun No subprovinces of this province are evident. The only change that noted is the gradual dropping out of warmer-water species and consequen increase in cold-tolerant forms to the north. Since some of the wide distributed cold-tolerant forms or their near relatives live off the coas of California and northern Baja California, there is a superficial simila ity between the faunas which has led to the hypothesis that there was recent marine passageway across the northern portion of the peninsula. careful analysis of the faunas appears to refute strongly such a possibi ity.

The north temperate Eastern Pacific faunal region has been studied C. L. Hubbs (1948). His analysis made use of clinid fishes and showed th these fishes were typical of the ichthyological fauna of the region. T present study reveals new information on but one portion of this faun region, Guadalupe Island. The offshore waters of this island contain large number of endemic species and subspecies, such as *Gibbonsia elegc erroli* and *Heterostichus rostratus guadalupensis*, showing considerable i lation from the mainland. The presence of the same subspecies of *Paracli integripinnis* off Guadalupe Island, off the San Benito Islands, and ne Port San Bartolomé on the peninsula indicates that the Guadalupe fauna derived from forms migrating from the south through Cerros (Cedros) Isl

the San Benito Islands. This assumption is further supported by the ence of *Gibbonsia norae* on both Guadalupe and West Benito islands, in- ades between *Gibbonsia elegans erroli* and the mainland form, *G. e. ns*, on West Benito Island, and examples of two otherwise tropical s in the Eastern Pacific, *Starksia* and the Tripterygiidae, on Guada- Despite the presence of these tropical fishes, the fish fauna of island in general is temperate.

ne faunas of several islands in the tropical Eastern Pacific faunal n show some isolation from those of the mainland. Clinid specimens been examined from only two, Cleopha and Socorro, which are definitely n the faunal region. The former, one of Las Tres Marias Islands, has demic subspecies of *Paraclinus mexicanus* and an endemic species of the erygiidae; the general fauna of this island indicates that the iso- on is not complete. The examined clinid fauna of Socorro Island is esented by two specimens of an endemic species of *Labrisomus*; the gen- fauna of the island indicates almost complete isolation.

linid faunal studies have thrown some light upon the zoogeography of Galapagos Islands. The results obtained agree very closely with those ished by Ekman (1935), Myers (1941), and others. The isolation of the a is shown by the 100% specific isolation of the clinid species living e. The nearest relatives of some species indicate that the fauna was ved from more than one faunal region. Except for *Myxodes schmitti*, members of that genus have been collected from south temperate waters. other clinids living in waters off the Galapagos belong to tropical ps.

IV. CONCLUSIONS

The following conclusions have been made from the above study:

1) The suborder Blennioidea of Regan, virtually the same as the order ilares of Jordan, is believed to be diphyletic. The so-called "blenny- s" are readily separable from the "tropical blennies." The former, the erfamily Zoarcicae, should be grouped with the Trachinicae, Uranoscop- e, and perhaps the Ophidiicae. The "tropical blennies" of Blenniicae n to be very closely related to the Percicae.

2) The classification within the Blenniicae likewise is changed exten- ely. The Eocene genus *Pterygocephalus* Agassiz is believed to be a mem- of a distinct family, the Pterygocephalidae, and indicates a closer ationship between the Percicae and Blenniicae than previously was sus- ted. The genera associated with *Tripterygion* Risso (including *Gobio- nus* Gill) are removed from the Clinidae and included in the family Trip- ygiidae. The genus *Neoclinus* Girard (as well as its relatives, *Stath- otus* Bean, *Chaenopsis* Gill, *Emblemaria* Jordan and Gilbert, and associ- d genera) is transferred from the Clinidae to the Blenniidae to form the family Chaenopsinae.

3) The tentative zoogeographic conclusions by Ekman as to the distribu- n of animals along the tropical Eastern Pacific shore line are supported l in some cases elaborated. The fauna of the Gulf of California is quite stinct from that of other Mexican Pacific coasts. The faunas to the th and to the south of Bania Honda, Panama, contain few species and sub- ecies in common. The northern boundary of the tropical Eastern Pacific nal region is placed between Abreojos Point and Port San Bartolomé, ja California. The endemism of the populations from the offshore islands ong the west coast of tropical America apparently increases with the geo- aphic distance from the mainland to the islands.

4) Secondary sexual dimorphism is present in most, if not all, of the ecies examined and has caused considerable confusion heretofore. The di-

morphism is most pronounced in the genera *Starksia* Jordan and Evermann and *Paraclinus* Mocquard. Although the differences between the sexes in *Starksia* are directly associated with sex function (the presence or absence of an intromittent organ), those in *Paraclinus* are not. In the past, authors have used the sexual differences as specific and even generic characters; obviously the male of a species cannot belong to a different genus from the female of the same species.

5) A very close correlation between the vertebral number and the total number of dorsal and anal fin rays was noted in the genus *Gibbonsia* Cooper. This correlation is not only intraspecific but also interspecific. Apparently it is not intergeneric.

6) The taxonomic portion of this investigation has led to the proposal of the following: a new subfamily, six new tribes, five new subtribes—three of which equal subfamilies of J. L. B. Smith (1946 and 1949)—two new genera, five new species, and twelve new subspecies. (See pages 50, 52.)

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